ENVIRONMENTAL AND BEHAVIORAL DETERMINANTS OF CHILDREN'S AGRICULTURAL INJURY

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DEDICATION

To my parents, Jay and Jenien Ferguson, my grandparents, Angus and Roberta Moore, my brother and sister-in-law, Brian and Heather Ferranti-Ferguson, and my cherished husband, Dennis Carlson.

I always have, and always will, aspire to be as smart as you.

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ABSTRACT

Children living on agricultural operations have elevated risks of injury. Prior research has shown this risk to be correlated within families; children whose parents had sustained prior agricultural injuries were more likely to be injured than children whose parents had not. The current study explores potential causal explanations for intra-familial risk of injury by examining associations between children's behaviors, environmental exposures, and injury.

Data from the Regional Rural Injury Study–II, a population-based nested case-control study conducted in 1999 and 2001, were used to examine the hypothesized causal pathways. Computer-assisted telephone interviews aided collection of demographic, behavior, exposure, and injury data from agricultural households, for six-month recall periods. A total of 1,941 children, ages six to <20 years, were identified. This included 379 injury events (cases) and 1,562 randomly-selected controls. Odds ratios (OR) and 95% confidence intervals (CI) were calculated using logistic regression, controlling for potential confounders by means of directed acyclic graphs.

Results indicated that children's behaviors are potential risk factors for agricultural injury: elevated risks were identified for children with high levels of depressive symptoms (OR=2.0, CI=1.0–4.0) and aggression (OR=1.7, CI=0.9–3.0), and low levels of self-regulation (OR=0.4, CI=0.2–0.8) and careful/cautious behavior (OR=1.9, CI=1.2–3.1). This effect appears to be, at least partially, mediated through differential exposure to high-risk environments. For example, children with high, versus medium/low, levels of depressive symptoms were more likely to work with dairy cattle (OR=2.7, CI=1.3–5.5), while those with high aggression were more likely to ride on tractors (OR=1.7, CI=1.0–2.9) and operate large machinery (OR=1.7, CI=0.9–3.1). Intra-familial injury did not appear to be mediated by high-risk behaviors and environmental exposures. Controlling for both, children whose parents reported past agricultural injuries had tripled risk, compared to those with neither parent injured (OR=3.1, CI=2.2–4.6).

These results suggest that children's risk of injury is partially driven by their behaviors, which influence their high-risk environmental exposures. However, a more complex pathway, beyond that of the measured behaviors and exposures, is involved in

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observed intra-familial risks. These findings are important steps toward improved understanding of the causal pathways leading to children's injuries.

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ORGANIZATION

The organization of this thesis provides initial chapters including an introduction, a comprehensive literature review, and a comprehensive presentation of the research design and methods. These chapters are followed by three papers (Chapters 4 – 6), which report the major findings from the study, as well as a Discussion section (Chapter 7). Because the three papers are prepared for publication in peer-reviewed journals, there is some redundancy with the first three chapters, pertinent to the literature cited and the methods presented, and the final chapter, pertaining to study validity and conclusions.

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CHAPTER 1

INTRODUCTION

Agriculture is among the most hazardous industries in the United States (US), with rates of fatal occupational injuries approximately eight times greater (29.2 per 100,000 workers) than for all industries combined (3.4 per 100,000 workers) (National Safety Council, 2006). Nonfatal injury is also a substantial issue among agricultural workers, particularly for those residing directly on farming and ranching operations. National rates of nonfatal injuries among agricultural workers are 1.3 times greater than for employees in all other private (non-government) industries combined (US Department of Labor (DOL), 2005). Given that the DOL data exclude all agricultural operations with fewer than 11 employees, i.e., many family-owned farms and ranches, these figures are known to underestimate the true rate (Leigh et al., 2004).

Unique to the agricultural population are unprecedented rates of injury-related mortality, morbidity, and disability among children (Brison et al., 2006; Goldcamp et al., 2004; Rivara, 1997; Pickett et al., 2001). The 1995–2000 US fatality rate for agricultural injuries, sustained by children less than 20 years of age, was estimated to be 9.3 per 100,000 child farm residents (Goldcamp et al., 2004). In Canada, the rate of fatal agricultural injury among children aged one to six years (14.9 per 100,000 person-years) was nearly twice the rate of all-cause, unintentional fatal injuries (8.7) (Brison et al., 2006). Reasons for these high rates among children include the proximity between the family household and the agricultural operation (Wilk, 1993), and economic and sociocultural pressures sustained by farm and ranch families (Kelsey, 1994; Kim and Zepeda, 2004; Lee et al., 1997).

Prior research has also found that risk of agricultural injury varies by family. Children with parents who had sustained agricultural injuries, versus those whose parents had not been injured, were at greater risk of subsequent injuries (Carlson et al., 2006). These associations were maintained while controlling for type of agricultural operation, which would approximate some, but not all, environmental hazards. Therefore, it is unknown whether the observed intra-familial correlation was driven by shared environmental exposures that are independent of operation type, such as type or pace of

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chores, or socioeconomic status, or by behavioral characteristics that are shared by both parents and their children.

While exposures to specific environmental hazards, such as tractors, machinery, and various types of animals, are known to affect adults' and children's risks of agricultural injury (Gerberich et al., 2001), behavior-related risk factors have not been as well characterized. Prior research has shown behavioral traits, such as distractibility or impulsivity, to be positively associated with children's risk of injury (Schwebel and Plumert, 1999; Bijur et al., 1986; Jaquess and Finney, 1994), while traits such as overactivity, inattentiveness, aggression, and impulsivity have been found to be independent risk factors for injury among people of all ages (Bijur et al., 1986; Davidson, 1987; Jaquess and Finney, 1994; Wazana, 1997). How behavioral characteristics might influence risk of agricultural injury among farm and ranch families remains to be determined.

To better understand observed intra-familial patterns of agricultural injury, this research examines the effects and inter-relatedness of behavioral traits, environmental exposures, and risk of injury among children. The aims of this dissertation were to: (1) Identify associations between children's behavioral traits and their risk of agricultural injury, (2) Examine associations between children's behavioral traits and their exposures to high-risk agricultural work environments, and (3) Determine whether associations between parents' and children's agricultural injuries persist, while accounting for important shared behaviors and/or environmental exposures. Improved knowledge of these associations could enhance and help target intervention efforts for the prevention of children's injuries in farming and ranching populations.

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REFERENCES

Bijur PE, Stewart-Brown S, Butler N: Child behavior and accidental injury in 11,966 preschool children. *American Journal of Diseases of Children*, 140: 487-492, 1986.

Brison RJ, Pickett W, Berg RL, Linneman J, Zentner J, Marlenga B: Fatal agricultural injuries in preschool children: Risks, injury patterns and strategies for prevention. *Canadian Medical Association Journal*, 174(12): 1723-1726, 2006.

Carlson KF, Langner DM, Alexander BH, Gurney J, Gerberich SG, Ryan AD, Renier CM, Mongin SJ: The association between parent and child agricultural injuries in the Regional Rural Injury Study – II. *Archives of Pediatrics and Adolescent Medicine*; In Press, 2006.

Davidson LL: Hyperactivity, antisocial behavior, and childhood injury: A critical analysis of the literature. *Developmental and Behavioral Pediatrics*, 8(6): 335-340, 1987.

Gerberich SG, Gibson RW, French LR, Renier CM, Lee T-Y, Carr WP, Shutske J: Injuries among farm children and youth in farm households: Regional Rural Injury Study – I (RRIS–I). *Injury Prevention*, 7: 117-122, 2001.

Goldcamp M, Hendricks KJ, Myers JR: Farm fatalities to youth 1995-2000: A comparison by age groups. *Journal of Safety Research*, 35: 151-157, 2004.

Jaquess DL, Finney JW: Previous injuries and behavior problems predict children's injuries. *Journal of Pediatric Psychology*, 19(1): 79-89, 1994.

Kelsey TW: The agrarian myth and policy responses to farm safety. *American Journal of Public Health*, 84(7): 1171-1177, 1994.

Kim J, Zepeda L. Factors affecting children's participation and amount of labor on family farms. *Journal of Safety Research*, 35(4): 391-401, 2004.

Lee BC, Jenkins LS, Westaby JD: Factors influencing exposure of children to major hazards on family farms. *Journal of Rural Health*, 13(3) 206-215, 1997.

Leigh JP, Marcin JP, Miller TR: An estimate of the US Government's undercount of non fatal occupational injuries. *Journal of Occupational and Environmental Medicine*, 46(1): 10-18, 2004.

National Safety Council: *Injury Facts, 2005-2006 Edition*. Itasca, IL: National Safety Council, 2006.

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Pickett W, Hartling L, Dimich-Ward H, Guernsey JR, Hagel L, Voaklander DC, Brison RJ: Surveillance of hospitalized farm injuries in Canada. *Injury Prevention*, 7:123-128, 2001.

Rivara FP: Fatal and nonfatal farm injuries to children and adolescents in the United States, 1990-1993. *Injury Prevention*, 3: 190-194, 1997.

Schwebel DC, Plumert JM: Longitudinal and concurrent relations among temperament, ability estimation, and injury proneness. *Child Development*, 70(3): 700-712, 1999.

US Department of Labor, Bureau of Labor Statistics: *Workplace injuries and illnesses in 2004.* USDL 05-2195, 2005. Accessed 06/06 at http://www.bls.gov/iif/oshwc/osh/os/osnr0023.pdf.

Wazana A: Are there injury-prone children? A critical review of the literature. *Canadian Journal of Psychiatry*, 42(6): 602-610, 1997.

Wilk VA: Health hazards to children in agriculture. *American Journal of Industrial Medicine*, 24: 283-290, 1993.

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CHAPTER II

BACKGROUND AND SIGNIFICANCE

Overview

This chapter synthesizes the body of literature that currently exists pertaining to children's risk of injury on family agricultural operations. Based on the matrix method described by Garrard (2004), tables summarizing design and major findings of studies examining potential risk factors for children's injury are presented at the end of the chapter.

Initially, descriptive research, including incidence rates and overall trends for agricultural injuries among adults and children, is identified. This is followed by a review of incidence rates and potential risk factors for children's injury, in general (corresponding to studies summarized in **Table 1**), and then for children's agricultural injury (**Table 2**). Finally, the limitations in current knowledge that will be addressed by this dissertation are identified.

Agricultural Injury

Rates of occupational mortality and morbidity for the United States (US) agricultural industry have been among the highest of all industries for many years. Based on national data for 2004 (National Safety Council (NSC), 2006), the rate of fatal occupational injuries was over eight times greater for agriculture (29.2 per 100,000 workers) than for all industries combined (3.4 per 100,000 workers). Identifying valid morbidity rates has been challenging due to the lack of adequate population-based data for nonfatal events. However, available data suggest that nonfatal injury is also a substantial issue among agricultural workers, particularly for those residing directly on the operations (Aherin and Riessenberg, 1978; Gerberich et al., 1991; 1993; 1998; 2003; Gunderson et al., 1989; 1990; Lee et al., 1996; Rivara, 1997; Stallones, 1989; 1990; Stueland et al., 1991; Welsch et al., 1989). The US Bureau of Labor Statistic's (BLS) most recent report on occupational injury and illness identified a rate of nonfatal agriculture, forestry, and fishing injuries that was 1.3 times greater than for all private (non-government) industries combined (US Department of Labor, 2005). Given that BLS data exclude all agricultural operations with fewer than 11 employees, as well as other

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issues resulting in underreporting, these figures could underestimate the true rate (Leigh et al., 2004).

Children's Agricultural Injury

Compared with other industries, children are at an unusually high risk of occupational injury in the agricultural sector. The 1995–2000 US fatality rate for agricultural injuries sustained by children less than 20 years of age (<20) was estimated to be 9.3 per 100,000 child farm residents (Goldcamp et al., 2004). In Canada, the rate of fatal agricultural injury among children, aged one to six years (14.9 per 100,000 person-years), was nearly twice the rate of all-cause, unintentional fatal injuries (8.7) (Brison et al., 2006).

Reasons for children's high risk include the proximity between the family household and the agricultural operation (Wilk, 1993), the traditional and valued use of child labor for agricultural tasks (Lee et al., 1997), as well as socio-cultural factors in the rural agricultural population (Kelsey, 1994; Kim and Zepeda, 2004). It was estimated in 1998 that about 1.9 million children <20 years of age were living and/or working on agricultural operations across the US (Myers and Hendricks, 2001); however, there are few data that indicate the proportion of these children who are directly involved with agricultural work (National Research Council, 1998). One survey involving rural high school students in Minnesota found that 45% of males and 21% of females were involved in agricultural work of some kind; among the 28% of these students living on farms, nearly three-quarters participated in farm work (Parker et al., 2002).

Identifying valid estimates of nonfatal agricultural injury rates for children is even more challenging than for adults, primarily since the data systems used to enumerate occupational injuries among adults do not include data for children. Reasons for this deficiency include the fact that children are not systematically identified as operation employees, and because many injuries occur while children are playing or bystanding in agricultural work areas, as opposed to actively working (Pickett et al., 2005). Inconsistencies among definitions used to characterize children, and injury, further confuse the issue.

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Though data on both adult and children's agricultural injury remain incomplete, some trends and risk factors have been identified in epidemiologic studies, as described in the following section. In 1998, the National Institute for Occupational Safety and Health, in collaboration with the US Department of Agriculture, conducted the first Childhood Agricultural Injury Survey on farm household youth <20 years of age. A follow-up effort in 2001 showed that the rate of children's nonfatal injury had decreased from 18.8/1,000 household youth to 15.7 over the course of these three years (Hendricks et al., 2005). However, while overall injury rates decreased, the rate for household females increased from 9.9 to 13.1/1,000 youth. While this overall decline may be a result of several major intervention efforts that were developed and implemented over the course of this time, empirical evaluations of these intervention efforts have either not been conducted, or have shown limited success (DeRoo and Rautiainen, 2000; Hartling et al., 2004).

Trends in Adult and Children's Agricultural Injury

Sources

Depending on the type of injury in question, certain exposures have been identified as the most common sources of injury. For fatal injuries, as well as those that resulted in health care treatment (assumed to be the most severe), tractors and machinery are often the most common sources (Brison et al., 2006; Myers and Hard, 1995; Pickett et al., 1999; Rivara, 1997). However, when a broad definition of injury is used, which may capture injuries that resulted in restricted activity but were perhaps not treated by a health care provider, animals and falls are also major sources (Boyle et al., 1997; Cogbill et al., 1985; 1991; Gerberich et al., 1991; 1993; 2003; Layde et al., 1996; Nordstrom et al., 1995; Rasmussen et al., 2000; Stueland et al., 1991).

Results of a 1991–1995 study of agricultural fatalities in Canada found that tractors and other agricultural machinery were associated with 48% and 24%, respectively, of agriculture-related deaths; the most frequent mechanisms of injury were rollovers and runovers (Pickett et al., 1999). Due in part to their small size, relative to the machinery, and possibly to immature musculoskeletal structures, coordination, and judgment skills, children are even more susceptible to fatal trauma from these sources.

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Salmi et al. (1989) reported that, from 1979–1985, machinery-related sources were the major causes of fatal agricultural injury among children, aged nine years and under, in Illinois and Wisconsin. Nationwide, between 1991 and 1993, 34% of agricultural fatalities among children aged 19 years and under were due to tractors and machinery (Rivara, 1997).

For children and adults enrolled in Phase 1 of the Regional Rural Injury Study – II (RRIS–II), a population-based study of injuries among agricultural family members in the Upper Midwest, the major sources of nonfatal agricultural injury were animals and falls. Among children (<20 years), 41% and 31% were associated with these sources, respectively, while, among adults, 31% and 23% involved these sources. While animals are repeatedly reported to be the most common source of nonfatal injury on agricultural operations, the degree to which this is observed varies by gender. In Phase 1 of the RRIS–II, 53% of agricultural injuries among females were associated with animals, yet this source accounted for only 28% of injuries among males. Similar results have been reported for other studies (Gerberich et al., 1993; 1998; Pickett et al., 2001; Stueland et al., 1991). Major injury sources have also been shown to differ by gender among children aged six to18 years; animals were the most common injury source among females, while tractors, implements, structures, and tools were the most common injury sources among males (Stueland et al., 1991). In part, these differences are due to differential exposure, as females spend a greater proportion of their overall agricultural work time with animals than with equipment (Schulman et al., 1997). When rates of injury have been calculated, based on hours of exposure, males and females were found to have similar rates (Gerberich et al., 1993; 2003; Stallones and Beseler, 2003).

Temporal Patterns

Injury incidence varies by time of year, and has been found, albeit inconsistently, to vary with days of the week. Among adults, temporal patterns follow the activities of planting and harvesting. Most studies find the spring and/or summer months to be associated with the greatest proportion of injuries (Gerberich et al., 2003; Pickett et al., 1999; Pratt et al., 1992; Stueland et al., 1991), though injuries during the fall months are also common (Pratt et al., 1992; Rasmussen et al., 2000). For children, injury incidence

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during the summer months is even more pronounced than for adults, most likely due to their higher exposure hours given summer breaks from school (Bancej and Arbuckle, 2000; Cogbill et al., 1985; Gerberich et al., 2003; Salmi et al., 1989; Stueland et al., 1991).

Small variations in the proportions of injuries by day of the week were identified in the 1990 Regional Rural Injury Study – I (RRIS–I, a population-based study of agricultural injuries and the basis for the RRIS–II). Cross-sectional analyses of these data showed more agricultural injuries occurred on Fridays and Saturdays than during other days of the week, with the smallest number occurring on Sundays (Gerberich et al., 1993). Other studies have found little difference among days of the week in terms of agricultural injuries treated in a health care facility (Lyman et al., 1999; Pratt et al., 1992), although one study found that women experienced a greater number of agricultural injuries on weekends (Stueland et al., 1991).

Types and Anatomical Locations of Injury

The multitude of tasks and relevant hazards associated with various agricultural operations results in a wide array of injury types and affected anatomical locations. A study of 16 agricultural fatalities treated in Wisconsin emergency departments found the major diagnoses to involve trauma to the head and lungs, as well as total blood loss and/or failure of multiple organ systems (Cogbill et al., 1991). Another study (Rivara, 1997) found that, of agricultural fatalities among US children <20, the most commonly affected body parts were the head (40%), trunk (26%), and brain (24%) (Rivara, 1997).

Nonfatal injuries involve various other body regions and injury types. In a study of medically-attended agricultural injuries in Iowa, the finger, fingernail, and hand (23%) and the lumbar region or back (15%) were the most common body parts injured, while sprains and strains (20%) as well as cuts and lacerations (20%) were the most common injury types (Sprince et al., 2003). In the RRIS-II, Phase 1, the most common sites for agricultural injury among adults were: spines and backs (31%); hands, fingers, and thumbs (19%); arms, elbows, and wrists (8%); and legs (7%) (Gerberich et al., 2003). The major types of injury were sprains and strains (34%); lacerations, punctures, and

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abrasions (24%); fractures and dislocations (21%); and contusions, crushing, and mangling (20%).

Types of nonfatal injury, and anatomical locations affected, may vary by age. While adults most commonly report sprains/strains and back injuries, children's injury profiles appear to differ. In the 1999 RRIS–II, Phase 1, the body parts most commonly affected among children were hands/fingers/thumbs (23%), legs (12%), and feet/heels/toes (12%) while the most common injury types were lacerations/punctures/abrasions (35%), contusions/crushing/mangling (28%), and sprains/strains (19%) (Gerberich et al., 2003). Other studies, however, have reported that sprains/strains were the most common injury type among children (Munshi et al., 2002; Weller et al., 2003).

Costs and Consequences of Agricultural Injury

Literature pertaining specifically to the costs and long-term effects of agricultural injury is scarce. Two studies by Leigh et al. (2000; 2001), using the human capital method of estimating costs of injury, found that agricultural injuries in 1992 led to $4.6 billion in direct and indirect costs in the US; these figures were comparable to the costs of job-related cancers, chronic obstructive pulmonary disease, and job-related circulatory disease. While providing evidence that the societal costs are substantial, use of these types of data implies little about the cost of injury for the injured individual, their family, or the agricultural operation.

Direct costs, such as those incurred for health care, may describe the impact on a smaller level. A study of agricultural operation owners, operators, and workers based in Alabama and Mississippi (McGwin et al., 2000) found that, while the majority of injuries were self-classified as minor or moderate in severity, the majority required medical attention. Of the injured participants in the RRIS–II, Phase 1, 79% of children and 82% of adults required some type of health care; 4% and 5% required hospitalization (Gerberich et al., 2003). Pratt et al. (1992) reported similar results from a population-based study of dairy farmers and workers, where 70% who incurred agricultural injuries required medical care.

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Measuring the amount of restricted activity, lost work time, and residual effects provides further insight into the costs and consequences of agricultural injuries. Results of the 1999 RRIS–II, Phase 1 (Gerberich et al, 2003), indicated that 79% and 73% of children's and adults' agricultural injuries, respectively, resulted in four or more hours of restricted normal activity. Of these, 39% and 32% reported restriction of normal activities for seven days or more, and 12% and 8% were restricted for one month or more. In the McGwin study (2000), 62% of participants reported lost work time as a result of their injuries. Nearly all of the participants experienced acute residual effects, including pain upon movement, and over half reported persistent pain related to their injury. In the RRIS–II, Phase 1, 23% of adults and 8% of children who reported agricultural injury events had persistent problems at the time of the interview, including pain, numbness, decreased range of motion, and permanent disability (Gerberich et al., 2003). Indicators such as health care use, lost work time, and persistent problems reveal substantial direct and indirect costs from agricultural injuries to individuals, families, and society.

Potential Risk Factors for Children's Injury (Table 1)

In the US, unintentional injuries are the leading cause of death among children over one year of age and are also a leading cause of hospitalization during childhood (Baker et al., 1992). It has been estimated that nearly 25% of US children seek treatment from a health care provider each year due to injuries (Scheidt et al., 1995). Though injury epidemiology is a relatively young field in the realm of public health, some risk factors, general and specific, have been identified over the course of the last several decades. For example, males are typically involved in injury events more frequently than females (Baker et al., 1992; Rivara et al., 1989), which is attributed to their more frequent risk taking behavior (Morrongiello, 1997; Rosen and Peterson, 1990), as well as differential exposures. The following sections describe further potential risk factors for children's injury, with particular focus on those that are likely to also influence children's risk on agricultural operations.

Behavioral Characteristics

In recent years, the study of behavioral risk factors for injury has subsided in favor of a more resolute focus on environmental hazards and passive interventions.

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However, given that most injury events involve a complex series of interactions between individuals and their environments, a multifaceted approach to the study of children's agricultural injury is warranted. Behavioral factors may influence how individuals respond to hazards in the environment; for example, how they appraise the risk of injury from a particular hazard or whether they choose to avoid a hazard entirely. Further, behavioral traits such as impulsivity or distractibility may influence children's overall exposure to, as well as interaction with, hazardous environments – an important consideration for children who live and/or play in agricultural settings. Results of a recent retrospective, population-based, matched cohort study among adults, 18 to 64 years of age, using linked administrative data from Canada showed that injured residents were more likely than non-injured residents to have sought mental health services prior to their injury events, as well as every post-injury year throughout a ten-year follow-up period (Cameron et al., 2006).

While the debate about the use of personal traits to characterize "injury prone" individuals will continue, certain behaviors have been critically examined as potential risk factors in the developmental psychology literature and, to a more limited extent, the injury epidemiology literature. A major strength of this line of research, as Caspi et al. observed in their studies of the Dunedin birth cohort, is that measures of personality in childhood can predict health-risk behaviors at young adulthood (Caspi et al., 1997; Pulkkinen, 1995). In the Dunedin cohort, it was found that children who were impulsive, restless, and distractible at three years of age were more likely to engage in one or more health risk behaviors, such as alcohol abuse, violence, or hazardous driving, at age 21.

Further studies have evaluated the association between children's behaviors such as aggression, impulsivity, hyperactivity, depressive symptoms, negative affectivity, and extraversion, and their childhood risk of injury. Results of these studies, though, have often been inconsistent. However, this is not unexpected given the varying definitions for behavioral traits and injury outcomes, as well as the distinct study populations involved.

Aggressive behaviors have been consistently associated with children's injury risk across studies (Wazana et al., 1997). A prospective study examining predictors of motor vehicle crashes found that high hostility in combination with poor self-esteem was

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associated with risk (Norris et al., 2000); consistent findings were reported by Chliaoutakis et al. (2002) from a cross-sectional study of young drivers in Greece. Further studies have shown aggression to have a positive association with injury risk, specifically among children (Bijur et al., 1986; Manheimer and Mellinger, 1967; Pulkinnen, 1995). For example, a study of medically-treated, unintentional injuries among nearly 12,000 preschool children showed those in the 90th percentile of aggression scores to have elevated risks for hospitalized and non-hospitalized injuries (Bijur et al., 1986). While most studies have generated combined effect estimates for males and females, the study by Pulkinnen (1995), involving all types of injuries, included stratified analyses and found that aggression was more strongly associated with injury for males than for females.

Measures of impulsivity have been used in various forms and also appear to have relatively consistent associations with injury risk across studies (Bijur et al., 1986; Jaquess and Finney, 1994; Manheimer and Mellinger, 1967; Ryb et al., 2006; Schwebel and Plumert, 1999). In the seminal Manheimer and Mellinger report, medical records for boys and girls, ages four to 18, were used to identify children who had and had not been treated for traumatic injuries. Comparisons of parent and teacher-reported behaviors across groups indicated that, for both boys and girls, those who were impulsive, careless, or unreliable were more likely to be in the injured and more-frequently injured groups (Manheimer and Mellinger, 1967). Evidence has suggested that this relation may be due to the strong association between impulsivity and high levels of risk-taking among individuals (Ryb et al., 2006).

Overactivity, hyperactivity, and attention-deficit hyperactivity disorder (ADHD) have been examined in various studies, though results have been inconsistent (Wazana et al., 1997). A review of the relevant literature in 1987 concluded that the true causal relationship between hyperactivity and injury was yet to be determined and that further prospective studies were needed (Davidson et al., 1987). While prior studies have shown activity-related measures to be associated with children's injury (Bijur et al., 1986; Langley et al., 1983; Manheimer and Mellinger, 1967; Matheny et al., 1971; Schwebel et al., 2004), findings from two prospective cohort studies found no association between

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hospitalized injuries, or those treated in emergency departments, and overactivity, hyperactivity, or concentration problems (Davidson et al., 1988; 1992). However, a recent study of high school students in China identified children with high ADHD tendency as being at greater risk of incurring unintentional injuries than those with low ADHD tendency (Lam et al., 2006). Two further exceptions have shown that *diagnosed* ADHD was associated with children's risk of self-reported, unintentional injury (Rowe et al., 2004) and teenagers' and young adults' risk of motor vehicle crashes and crash-related injuries (Barkley et al., 1993). Children with ADHD tend to anticipate fewer consequences from their risky behaviors, and also utilize fewer methods of injury prevention (Farmer and Peterson, 1995).

The effect of depressive symptoms on children's risk of injury remains uncertain. To date, most studies have relied on data that were collected in a cross-sectional manner, potentially leaving results and subsequent interpretations susceptible to bias. This limitation is especially important to consider, given that depression and depressive symptoms are commonly a result of injury (Keogh et al., 2000). One cross-sectional study by Peele and Tollerud (2005) found that depression was positively associated with women's, though not men's, rates of occupational injuries; this study was not restricted to workers of any particular age, though adults likely comprised the majority of participants. Among children, Rowe et al. (2004) found that diagnosed depression was positively associated with self-reported, unintentional burns, poisonings, and fractures, though this study was also based on cross-sectional data. One prospective cohort study identified depressive symptoms as a risk factor for self-reported, unintentional injury among rural county residents older than 18 years of age (Tiesman et al., 2006). To date, the association between depressive symptoms and risk of injury among children remains to be examined in a prospective manner. This issue is especially relevant for the agricultural population, given the documented prevalence of depressive symptoms (Fraser et al., 2005; Linn and Husaini, 1987; Scarth et al., 2000; Stallones et al., 1995).

Few personality and behavioral factors have been studied as potential risk factors for occupational injuries. Those studies that have examined these factors, such as negative affectivity and extraversion, indicate positive associations with injury risk.

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Negative affectivity, defined as the disposition to perceive situations with negative emotion and lack of emotional stability, has been reported to be associated with occupational injuries among employed adults and adolescents (Frone, 1998; Sutherland and Cooper, 1991). Sutherland and Cooper (1991) also found an association between coronary-prone, "type A" personalities and occupational injury, while Hansen (1989) found that extreme extraversion and neuroticism were associated with occupational injuries. It is likely that these behaviors, or their antecedents, would also increase risk of injury among children on farming and ranching operations.

Environmental Factors

While many previous studies examining risk factors for children's injury have focused on individual child attributes (i.e., demographics and behavioral patterns), research into environmental exposures and injury has also been substantial. In general, trends and potential risk factors appear to vary by gender and by age. For example, it has been shown that most injuries among children of preschool age occur in and around the home (Shannon et al., 1992), while children attending school more frequently incur injuries while they are away from home (Morrongiello, 1997; Scheidt et al., 1995).

Certain environmental risk factors at home and in the school environment are known to drive the risk of these injuries among children. Levels of parental and/or adult supervision are often considered the most important correlates of children's injuries (Morrongiello et al., 2006), with most studies showing a protective effect of parental supervision on children's risk of injury (Morrongiello et al., 2001; Morrongiello and House, 2004; Peterson et al., 1987). In the home environment, sources of injury to children include fire/flames/smoke, choking, suffocation, and drowning (NSC, 2006). Infants represent the highest risk group for deaths related to house fires, scald burns, and choking; infant boys sustain the highest rates of choking-related fatalities (Dowd et al., 2002; Rosen and Peterson, 1990). While many potential risk factors for home injuries exist, it is clear that socio-economic status is a strong predictor of this risk (Dowd, 2002).

Children are often injured while playing or engaging in sports activities, either at school or outside their homes. Mediating such injuries is challenging, as parents must balance the injury risks with the benefits derived from outdoor activities, such as

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physical/mental competence as well as basic enjoyment (Rosen and Peterson, 1990). While motor vehicle crashes are the leading cause of fatal injuries for all persons aged two and older, drowning is the second leading cause among children two to four, six to seven, nine, and 11 to 16 years of age (NSC, 2006). Risk factors for drowning include children's inability to swim, particularly among younger children, and use of alcohol or drugs by older children (Dowd et al., 2002). Lack of supervision has been identified consistently as a strong risk factor for drowning/submersion fatalities (Rosen and Peterson, 1990).

Based on population-based data from the National Health Interview Survey, children sustain the highest rates of injury related to sports and recreation activities. Nearly 20% of these occur at school while another 17% occur in or around the home (NSC, 2006). Based on rates per person, and not taking exposure hours into consideration, bicycling, basketball, football, and playground activities are the most frequent sources of these injuries. Despite the fact that bicycling is a leading and preventable source of children's injury, use of bicycle helmets to prevent these injuries has been low. Only about 25% of children who ride bicycles frequently wore helmets (Dowd et al., 2002). Similar to injuries in the home, lack of supervision has also been noted as a potential risk factor for injuries sustained from playground-related injuries (Rosen and Peterson, 1990).

The identification of environmental risk factors for injury has been critical to the empirical study of agricultural injuries among children. For example, exposures to specific environmental hazards, such as tractors, machinery, and various types of animals, have been shown to increase children's risk of injury on agricultural operations (Gerberich et al., 2001; 2003; 2004). These and other potential risk factors for children's agricultural injury will be described in detail in the following section.

Potential Risk Factors for Children's Agricultural Injury (Table 2)

Gender

As is also identified for children's injury, in general, males are nearly always identified as having the highest risk of agricultural injury (Cogbill et al., 1991; Dimich-Ward et al., 2004; Gerberich et al., 1993; 2003; 2004; Pickett et al., 1999; Pratt et al.,

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1992; Stallones, 1990; Stueland et al., 1991). Whether this is due to gender-specific behavioral traits, the greater number of hours in which males are involved with agricultural work (Browning et al., 2003), or a combination, remains unknown.

What is certain is that males of all ages sustain more fatal and nonfatal agricultural injuries than females. Myers and Hard (1995) reported that males accounted for 98.5% of the agricultural production and services related fatalities in the National Traumatic Occupation Fatalities (NTOF) database in 1980–1989, which includes persons 16 years of age and older. A separate study found that, among children 19 years and under, males had a fatality rate 2.4 times higher than females, and this gender difference increased with age (Rivara, 1997). Recent case-based data from the Canadian Agricultural Injury Surveillance Program also found that males had greater proportions of agricultural fatalities than females (Dimich-Ward et al., 2004).

In Phase 1 of the RRIS–II, the rate of nonfatal agricultural operation-related injury events per 1,000 people was nearly two times greater among males than females (Gerberich et al., 2003). However, indication that this gender difference is specifically due to differences in exposure time emerged when rates were calculated by hours worked; males and females were then found to have nearly equivalent rates of agricultural injury. A study of North Carolina teen agricultural workers, which found that males and females had significantly different exposures in 13 of the 19 different agricultural tasks analyzed (Schulman et al., 1997), sheds more light on this issue of differential exposure.

Multivariable analyses, from both Phase 1 and Phase 2 of the RRIS–II (Gerberich et al., 2003; 2004), identified males as being three times more likely to incur an agricultural injury, even after adjusting for age and state of residence. This result was similar to that identified from a study of children, 19 years and under, living in Ontario, Canada (Bancej and Arbuckle, 2000); males, compared with females, had an increased risk of injury for all age groups analyzed. In addition to agricultural injury, in general, separate multivariable analyses of data from the RRIS–I, and Phase 1 of the RRIS–II, showed that males were at increased risk of machinery-related injury (Gerberich et al., 1998) as well as tractor-related injury (Carlson et al., 2005; Lee et al., 1996).

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Age

In general, higher rates of agricultural injury are reported for adults than children (Gerberich et al., 2003; 2004), with older adults associated with the highest rates. Adults aged 55 to 64 years and 65+ years, in Phase 1 of the RRIS–II, had the highest rates of agricultural injury related to their own operation (157.7 and 150.0 injury events per 1,000 persons per year) (Gerberich et al., 2003). In Phase 2, the rate for those 55 to 64 years was also the highest (132.3), but the rate for those 65+ was nearly half (68.7). However, this rate was still elevated compared to the average rate of agricultural injury among children (29.6) (Gerberich et al., 2004). Other studies have also found increased rates or incidence of injury among adults and elders (Cogbill et al., 1991; Nordstrom et al., 1995; Pickett et al., 1999; Pratt et al., 1992). Myers and Hard (1995), using the NTOF database of persons 16 years of age and older, found that adults, particularly those over 65 years of age, in the agricultural production and service sector had the highest fatality rates of all sectors. Similar to gender-specific rates, age-specific rates, when based on number of hours worked, are distinct from rates based on person counts. In Phase 1 of the RRIS–II, children, compared with adults, experienced a similar rate of injury events per 100,000 hours worked (Gerberich et al., 2003). Rasmussen et al. (2000) found that rates calculated according to hours worked were actually higher for children than adults.

Prior Injury, Individual and Family

Prior injury has been found to be associated with injury risk for a variety of injury types, including sports (Emery and Meeuwisse, 2001; Hagel et al., 2003), motor vehicle (Slap et al., 1991), and occupational (Salminen and Heiskanen, 1997; Schneider et al., 2000) injuries. Further, medical records studies have shown past medically-attended injuries, in general, to be associated with risk of future injuries, among both adults and children (Kendrick and Marsh, 1997; Madden et al., 1997; Spady et al., 2004). Similarly, past agricultural injuries for which health care was sought, or which resulted in restricted activity, were shown to be risk factors for agricultural injuries during a one-year surveillance time period (Elkington, 1990). Other studies have also found prior agricultural injury to be a risk factor for subsequent injuries (Browning et al., 1998; Gerberich et al., 2003; Low et al., 1996; McGwin et al., 2000), one of which (Browning

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et al., 1998) indicated this association may be a result of long-term effects of the prior injuries, such as permanent disability, on one's ability to work. However, association between injury history and risk of injury could also reflect patterns of environmental exposure on the operation, such as hazardous work environments, and/or behavioral patterns, such as risk-taking.

In addition to personal risk, prior injury among siblings has also been indicated as a risk factor for children's injury. This was first identified in a study of injuries treated in emergency departments in Washington State, where families of treated children were at increased risk of incurring another child injury within 90 days of the primary injury (Johnston et al., 2000). A further study by Johnston et al. (2003) found similar results pertaining to any unintentional, medically treated injuries; siblings were at 50% greater risk within 180 days of the primary injury and, when minor injuries were excluded, their risk was nearly 100% greater. Despite the evidence of intra-familial injury risk, there is a lack of information on the interrelationship among behavioral traits and environmental exposures, and the effect on risk of agricultural injury. Further knowledge in this area could greatly inform agricultural injury prevention efforts by focusing interventions on the most pertinent population and most important risk factors for injury.

Data from Phase 1 of the RRIS–II showed that prior agricultural injury among parents was associated with risk of agricultural injury among their children (Carlson et al., 2006). This risk was 2.5 times greater for children whose mothers reported having been injured before the study compared with those whose mothers had not. Children whose fathers had been injured had doubled risk of injury compared to those whose fathers had not incurred a prior injury. Further, parents injures appeared to be associated with children's risk in an additive manner; children whose parents had both been injured prior to the study had more than four times the risk as children with neither parent injured. These results support the theory of an intra-familial pattern of injury, which could again be due to specific patterns of environmental exposure, in this case on the family operation, or could be due to common behavioral traits between parents and their children.

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While the associations between parents' and children's injuries in the RRIS–II data were maintained even after controlling for type of operation, which would approximate some environmental exposures, it is feasible that environmental patterns beyond those specific to operation types could have been driving the association. These might include type or age of equipment in use, safety mechanisms present and in use, types of animals present, holding facilities present and in use, facilities management practices, or overall production levels (i.e., "busyness") of certain operations. However, as behavioral traits are both inheritable and learned (Saudino et al., 2005), shared behavior is also a feasible explanation for the association between parents' and children's injuries. In literature pertaining to health and safety, parents' risk-taking behaviors are commonly associated with those of their children. For example, parents' health-risk behaviors, such as poor eating, lack of exercise, and use of alcohol or cigarettes, is reported to be associated with the same behavior among children (White et al., 2000; Wickrama et al., 1999), and parents with poor driving records are more likely to have children with poor driving records (Ferguson et al., 2001). Overall, parents' driving styles are associated with their children's driving styles, and this association tends to be gender-specific, i.e., stronger between mothers and their daughters and fathers and their sons (Taubman et al., 2005).

Behavioral Traits

Despite these known associations between behavior and injury risk, most studies of agricultural injury analyze the effect of environmental exposures on risk of injury without considering behavioral traits. One exception is the inclusion of measures of depression, which appear to be associated with risk of agricultural injury (Nordstrom et al., 2001; Sprince et al., 2003). As previously indicated, it is likely that some behavioral traits affect risk of injury, independently, while others may increase risk through intermediate environmental exposures. For example, children who are perceived as responsible by their parents may be assigned more chores than children perceived as irresponsible or immature; this would increase risk as hours of agricultural work exposure are associated in a dose-response manner with an increased risk of agricultural injury (Boyle et al., 1997; Elkington, 1990; Gerberich et al., 2003; Stueland et al., 1996; 1997).

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On the other hand, it is hypothesized that children who are easily distracted or impulsive may not be assigned as many or as hazardous of tasks due to protective parenting. However, these children may have an inherent greater risk of injury, given our current understanding of children's behaviors and injury outcomes.

Physical Environment

The physical environment on agricultural worksites is the major reason for the high rates of occupational mortality and morbidity in this sector. It is also why such a high proportion of children's injuries are sustained by those not actually engaged in agricultural work at the time of the injury (Pickett et al., 2005). Although it is difficult to characterize particular types of operations as being more hazardous than others, due to the wide variety of exposures found on any given operation, specific high-risk exposures common to many operations have been identified; these include various types of animals, machinery, and equipment.

Exposure to animals is repeatedly shown to increase risk of agricultural injury. Results of the 1999 RRIS–II, Phase 1 and Phase 2 efforts, found that children who worked with horses, sheep, or beef cattle were at least two times more likely to incur an agricultural injury than those who did not (Gerberich et al., 2003; 2004). The odds of injury among those working with dairy cattle, swine, or poultry were also suggestive of an increased risk. In the RRIS–I, children who worked with dairy cattle had 1.6 times the risk of injury as those who did not work with dairy (Gerberich et al., 2001). Overall, animal operations may be more hazardous than those involving just field crops. A study by Stallones et al. (1997) found that male farm residents whose primary cash crops were beef, dairy, or feedlot operations were nearly five times more likely to be injured than the comparison group of all other cash crops.

Exposure to various types of machinery has also been associated with increased rates of agricultural injury. Analyses of the RRIS–I injury data involving children, ages <20 years, found that those who operated a tractor, compared with those who did not, had a 40% higher rate of injury (Lee et al., 1996). The RRIS–II Phase 1 and Phase 2 data indicated that children who operated or rode in a motor vehicle for work related to the operation were four and three times, respectively, more likely to incur an agricultural

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injury (Gerberich et al., 2003; 2004). Further, those who operated a tractor were 60% and 90% more likely to incur an injury, while risk ratios for those who rode on tractors were suggestive of an increased risk. In both studies, the tasks of operating large machinery or small equipment were also suggestive of an increased risk of injury. This idea is strengthened by the results of a study among Danish agricultural workers (Rasmussen et al., 2000); it was reported that repair and maintenance-work involving machinery were the most hazardous tasks on the operations, relative to the number of task-specific work hours.

Interventions for Agricultural Injury

Relatively few prevention measures aimed at reducing mortality and morbidity on agricultural operations have been widely adopted. This is likely due to a combination of factors, including the resistance of agricultural communities to government regulation (Kelsey, 1994), the lack of enforcement of regulations already in existence, and the persistent perception in the agricultural community of injuries as uncontrollable and unavoidable (Murphy, 1992). Interventions that have been implemented to date have focused on improved engineering, economic incentives, policy, and educational efforts; when empirically evaluated, however, few efforts have been found to be efficacious (DeRoo and Rautiainen, 2000; Hartling et al., 2004).

Engineering interventions are generally the most effective at preventing injuries (Robertson, 1998). However, the cost of improved or updated technology, in conjunction with the narrow profit margin of most agricultural operations, makes implementation of such interventions challenging. One intervention known to be highly effective for the prevention of fatalities is the installation of rollover protection structures (ROPS) on tractors. In Sweden, where ROPS have been mandatory on all tractors since the late 1950s, fatalities due to tractor rollovers have decreased by 95% (Springfeldt et al., 1998; Thelin, 2002). In the US, however, the installation of ROPS on tractors is not mandatory by law, although the "General Duty Clause" (section 5a1) of the Occupational Safety and Health Act might govern some specific employers (US Department of Labor, 2006). Legally, the installation of ROPS falls under a voluntary standard implemented by the American Society of Agricultural Engineers (1985), which has implications only for the

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liability of a manufacturer in the case of injury. In 1976, however, American tractor manufacturers agreed to install ROPS on all newly manufactured tractors. Unfortunately, this has not ensured their use on all agricultural operations; pre-1976 tractors are not required to be equipped with ROPS, and farmers occasionally remove the ROPS from newer tractors in order to access low-clearance areas on an operation.

Further legal and manufacturing issues impede the widespread use of engineering intervention measures. To increase the use of ROPS, several "retrofitting" campaigns have attempted to fit ROPS to older tractors, with varied results. While economic analyses have shown such campaigns to be cost-effective (Myers et al., 2004), retrofitted ROPS can, and are, often removed by tractor operators. Studies have found that many tractors operated on North American farms, including nearly half of those driven by children, are not equipped with ROPS (CDC, 1993; 1997; Marlenga et al., 2004b). This picture may be evolving, however, as older tractors are replaced with new machines already fitted with ROPS.

A model of economic incentive for the reduction of agricultural injury has been developed and instituted by researchers at the University of Iowa (Rautiainen, 2001). The Iowa Certified Safe Farm Program combines operation safety assessments, occupational screening, and educational components. The safety assessment involves a checklist of hazards associated with the physical features of operations while the occupational health services include screening by nurses at local clinics. Those who participate in the program have the opportunity to share the theoretical cost savings from reduced injuries through a reduction in insurance premiums; for evaluative purposes, monetary compensation from the investigators is being used at this time. To receive this compensation, operations must achieve a minimum level of safety as indicated by a safety score. To date, controlled evaluation trials have documented improvements in operation hazard levels, but not injury rates (Rautiainen et al., 2004).

It would be expected that government regulations would provide some level of protection for children working on agricultural operations. Many family operations, however, are exempt from federal labor and safety regulations as they employ fewer than 11 workers. For example, the 1970 Occupational Safety and Health Act includes

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standards related to the safety of agricultural workers (part 1928); however, farms and ranches employing fewer than 11 workers are exempt (Kelsey, 1994; US Department of Labor, 2006). The Fair Labor Standards Act (FLSA), which sets standards related to minimum wage, overtime, and child labor, restricts the types and hours of exposure for children working on agricultural operations during school hours. It also prohibits all work with specific high-risk exposures by children less than 16 years of age, under the Hazardous Occupations order for Agriculture (US Department of Labor, 1984). However, the FLSA is also limited to operations with 11 or more employees and excludes children working for their parents on family operations (US Department of Labor, 1984).

Given the poor regulatory environment of US agricultural operations and the potential cost of economic incentives, educational interventions are the most commonly used approaches for the prevention of agricultural injury. However, educational measures are generally regarded as the least efficacious because they require active changes on the part of those at risk (Robertson, 1998). As such, empirical studies have found no protective effect of safety training on agricultural injury (Lewis et al., 1998; Sprince et al., 2003). A paucity of evaluative studies, however, prevents conclusions regarding the efficacy of educational efforts in the agricultural population.

One of the more widely publicized educational interventions, the North American Guidelines for Children in Agricultural Tasks, or NAGCAT, was introduced in 1999 and is currently available on the Internet (www.nagcat.org). The NAGCAT are a set of consensus guidelines that address children's development-based capabilities and assist parents in assigning appropriate and safe tasks to children seven to 16 years of age. Hazards associated with certain tasks, as well as parents' responsibilities for training and supervision, are identified. Evaluations on the effectiveness of this potentially important educational tool in preventing injuries have been sparse. Previously, one study examined the hypothetical efficacy of the guidelines by using a case-series of hospitalized childhood agricultural injuries. It was found that nearly one-half of these hospitalizations may have been prevented had the NAGCAT been employed by the farm or ranch families (Marlenga et al., 2004b). In addition, two randomized, controlled trials evaluated the effectiveness of various NAGCAT dissemination strategies (Marlenga et al., 2002;

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Gadomski, 2003), showing that active, enhanced dissemination improved parental usage and knowledge. It is expected that widespread use of the NAGCAT has reduced, or delayed, children's high-risk exposures on agricultural operations. Recent results of the randomized controlled trial led by Gadomski have indicated this to be true, as dissemination of the guidelines was associated with a decrease in the incidence of work-related injuries among children on intervention, versus control, operations (Gadomski et al., 2006).

There are several other educational programs that focus on agricultural injury prevention, specifically among children. Farm Safety 4 Just Kids is a nonprofit organization based in Iowa with chapters throughout the US. The population-based educational component of this program involves community farm safety day camps, containing particular emphasis on animal, tractor, and machinery safety. The Agricultural Disability Awareness and Risk Education (AgDARE) program is a classroom-based intervention funded by the National Institute of Occupational Safety and Health (NIOSH). AgDARE involves both narrative and physical simulations, led by community health nurses in concert with classroom teachers, which acquaint children with four disabilities common among the agricultural community: farmer's lung; upper extremity amputation; paraplegia; and noise-induced hearing loss (Reed and Kidd, 2004). While neither program has been evaluated for efficacy, in terms of injury reduction, one NIOSH-sponsored project is currently measuring this outcome for children involved in the Farm Safety 4 Just Kids day camps. An additional study, currently in progress and also sponsored by NIOSH, is evaluating the effect of an educational curriculum on the reduction of children's agricultural injury in rural Minnesota schools (Parker, 2000).

Limitations of Current Research on Children's Agricultural Injury

Although there is still some question about which environmental exposures causally affect children's risk of agricultural injury, a fairly large number of studies have characterized the environmental hazards typical of agricultural operations. However, while certain behavioral traits are known to increase risk of children's injury, in general, research into behaviors as risk factors for agricultural injury has lagged behind the study of physical environments. While debate will continue about the suitability of training-

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based (active), versus environmental (passive) interventions, it is likely that a comprehensive approach to agricultural injury prevention programs is warranted. Thus, further insight into the effect of behavioral traits on risk of injury, including the potential interplay between behaviors and environmental exposures, will likely improve such efforts. This information could also elucidate causes of the observed intra-familial associations in injury, particularly between parents and their children.

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REFERENCES

Aherin RA, Riessenberg L: *1978 Minnesota Farm Accident Survey*; University of Minnesota Agricultural Extension Service, St. Paul, MN, 1978.

American Society of Agricultural Engineers: ASAE Standards, 32nd Ed. *X318.10: Tractor roll-over protection.* St. Joseph, Minnesota: ASAE, 1985.

Baker SP, O'Neil B, Ginsburg M: *The injury fact book.* New York: Oxford University Press, 1992.

Bancej C, Arbuckle T: Injuries in Ontario farm children: A population based study. *Injury Prevention*, 6(2): 135-140, 2000.

Barkley RA, Guevremont DC, Anastopoulos AD, DuPaul GJ, Shelton TJ: Driving-related risks and outcomes of attention deficit hyperactivity disorder in adolescents and young adults: A 3- to 5-year follow up survey. *Pediatrics*, 92: 212-218, 1993.

Bijur PE, Stewart-Brown S, Butler N: Child behavior and accidental injury in 11,966 preschool children. *American Journal of Diseases of Children*, 140: 487-492, 1986.

Boyle D, Gerberich SG, Gibson RW, Maldonado G, Robinson A, Martin F, Renier CM: Case-control study of dairy-operation related injuries: Rate ratios associated with dairy activities. *Epidemiology*, 8: 37-41, 1997.

Braun BL, Gerberich SG, Sidney S: Injury events: Utility of self-report in retrospective identification in the USA. *Journal of Epidemiology and Community Health*, 49: 604-605, 1994.

Brison RJ, Pickett CW: Nonfatal farm injuries in Eastern Ontario: A retrospective survey. *Accident Analysis and Prevention*, 23: 585-594, 1991.

Brison RJ, Pickett CW: Nonfatal farm injuries on 117 Eastern Ontario Beef and Dairy farms: A one year study. *American Journal of Industrial Medicine*, 21: 623-636, 1992.

Brison RJ, Pickett W, Berg RL, Linneman J, Zentner J, Marlenga B: Fatal agricultural injuries in preschool children: Risks, injury patterns and strategies for prevention. *Canadian Medical Association Journal*, 174(12): 1723-1726, 2006.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Browning SR, Westneat SC, Donnelly C, Reed D: Agricultural tasks and injuries among Kentucky farm children: Results of the Farm Family Health and Hazard Surveillance Project. *Southern Medical Journal*, 96(12): 1203-1212, 2003.

Browning SR, Truszczynska H, Reed D, McKnight RH: Agricultural injuries among older Kentucky farmers: The Farm Family Health and Hazard Surveillance Study. *American Journal of Industrial Medicine*, 33(4): 341-353, 1998.

Cameron CM, Purdie DM, Kliewer EV, McClure RJ: Mental health: A cause or consequence of injury? A population-based matched cohort study. BMC Public Health, 6: 114, 2006.

Carlson KF, Gerberich SG, Church TR, Ryan AD, Alexander BH, Mongin SJ, Renier CM, Zhang X, French LR, Masten A: Tractor-related injuries: A population-based study of a five-state region in the Midwest. *American Journal of Industrial Medicine*, 47: 254-264, 2005.

Carlson KF, Langner DM, Alexander BH, Gurney J, Gerberich SG, Ryan AD, Renier CM, Mongin SJ: The association between parent and child agricultural injuries in the Regional Rural Injury Study – II. *Archives of Pediatrics and Adolescent Medicine*; In Press, 2006.

Carr P, French LR, Gerberich SG, Gibson RW, Gunderson PD, Renier C: Supplemental ICD-9-CM external cause codes for agricultural injuries; *Third International Symposium: Issues in Health, Safety and Agriculture*, Saskatoon, Saskatchewan, May 1992.

Caspi A, Harrington H, Moffitt TE, Begg D, Dickson N, Langley J, Silva PA: Personality differences predict health-risk behaviors in young adulthood: Evidence from a longitudinal study. *Journal of Personality and Social Psychology*, 73(5): 1052-1063, 1997.

Centers for Disease Control and Prevention (CDC): Public Health Focus: Effectiveness of rollover protective structures for preventing injuries associated with agricultural tractors. *Morbidity and Mortality Weekly Report*, 42(3): 57-59, 1993.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Centers for Disease Control and Prevention (CDC): Use of rollover protective structures – Iowa, Kentucky, and Ohio, 1992-1997. *Morbidity and Mortality Weekly Report*, 46(36): 842-845, 1997.

Chliaoutakis JE, Demakakos P, Tzamalouka G, Bakou V, Koumaki M, Darviri C: Aggressive behavior whie driving as predictor of self-reported car crashes. *Journal of Safety Research*, 33: 431-443, 2002.

Cogbill TH, Busch HM: The Spectrum of agricultural trauma. *Journal of Emergency Medicine*, 33: 205-210, 1985.

Cogbill TH, Busch HM, Stiers GR: Farm accidents in children. *Pediatrics*, 76: 562-566, 1985.

Cogbill TH, Steenlage ES, Landercasper J, Strutt PJ: Death and disability from agricultural injuries in Wisconsin: a 12-year experience with 739 patients. *Journal of Trauma*, 31(12): 1632-1637, 1991.

Davidson LL: Hyperactivity, antisocial behavior, and childhood injury: A critical analysis of the literature. *Developmental and Behavioral Pediatrics*, 8(6): 335-340, 1987.

Davidson LL: Hyperactivity in school-age boys and subsequent risk of injury. *Pediatrics*, 90(5): 697-702, 1992.

Davidson LL, Hughes SJ, O'Connor PA: Preschool behavior problems and subsequent risk of injury. *Pediatrics*, 82(4): 644-651, 1998

DeRoo LA, Rautiainen RH: A systematic review of farm safety interventions. *American Journal of Preventive Medicine*, 18(4 Suppl): 51-62, 2000.

Dimich-Ward H, Guernsey JR, Pickett W, Rennie D, Hartling L, Brison RL: Gender differences in the occurrence of farm related injuries. *Occupational and Environmental Medicine*, 61(1): 52-56, 2004.

Dowd MD, Keenan HT, Bratton SL: Epidemiology and prevention of childhood injuries. *Critical Care Medicine*, 30(Suppl): S385-S392, 2002.

Elkington JM: *A Case-control study of farmwork related injuries in Olmsted County, Minnesota.* Doctoral Thesis. Minneapolis: University of Minnesota, 1990.

Emery CA, Meeuwisse WH: Risk factors for groin injuries in hockey. *Medicine and Science in Sports and Exercise*, 33(9): 1423-1433, 2001.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Farmer JE, Peterson L: Injury risk factors in children with attention deficit hyperactivity disorder. *Health Psychology*, 14(4): 325-332, 1995.

Ferguson SA, Williams AF, Chapline JF, Reinfurt DW, De Leonardis DM: Relationship of parent driving records to the driving records of their children. *Accident Analysis and Prevention*, 33(2): 229-234, 2001.

Fraser CE, Smith KB, Judd F, Humphreys JS, Fragar LJ, Henderson A: Farming and mental health problems and mental illness. *International Journal of Social Psychiatry*, 51(4): 340-349, 2005.

French LR, Carr P, Gerberich SG, Gunderson P, Gibson R, Melton LJ III, Elkington JM: Reliability of "E"-coding farm-related injuries using the *International Classification of Diseases,* ninth revision (ICD-9) and a modified version of ICD-9. *American Journal of Epidemiology*, 130(4): 826, 1989.

Frone MR: Predictors of work injuries among employed adolescents. *Journal of Applied Psychology*, 83(4): 565-576, 1998.

Gadomski A, Burdick P, Jenkins P, Ackerman S: Efficacy of the North American Guidelines for Children's Agricultural Tasks in Reducing Childhood Agricultural Injuries. *American Journal of Public Health*, 96(4): 722-727, 2006.

Gadomski A, Burdick P, Jenkins P, Ackerman S, May J: Randomized field trial to evaluate the effectiveness of the North American guidelines for childhood agricultural injury prevention (NAGCAT) [abstract 4212.0]. *American Public Health Association, 131st Annual Meeting*, November, 2003.

Garrard JM: *Health sciences literature review made easy: The matrix method.* Sudbury, MA: Jones and Bartlett, 2004.

Gerberich SG, Gibson RW, Gunderson PD, French LR, Melton LJ III, Erdman A, Smith P, True JA, Carr WP, Elkington J, Renier CM, Andreasson LR. *The Olmsted Agricultural Trauma Study (OATS): A population-based effort.* Report to the Centers for Disease Control, 1991.

Gerberich SG, Gibson RW, French LD, Carr P, Renier CM, Gunderson P, Martin F, True J, Shutske J, Brademeyer K. *The Regional Rural Injury Study – I (RRIS–I): A population-based effort.* A Report to the Centers for Disease Control, 1993.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Gerberich SG, Gibson RW, French LR, Lee T-Y, Carr WP, Kochevar L, Renier CM, Shutske J: Machinery-related injuries: Regional Rural Injury Study – I (RRIS–I). *Accident Analysis and Prevention*, 30(6): 793-804, 1998.

Gerberich SG, Gibson RW, French LR, Masten A, Renier C, Church TR, Luan X, Shutske J, Carr WP, Peterson J, Howse G: Etiology and consequences of injuries among children in farm households: Regional Rural Injury Study–II. *NIOSH NOIRS meeting*, Pittsburgh, October, 2000.

Gerberich SG, Gibson RW, French LR, Church TR, Alexander BH, Shutske J, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR, Zhang X, Jensen KE: *Etiology and consequences of injuries among children in farm households: A regional rural injury study.* A report to the Centers for Disease Control and Prevention. Minneapolis: Regional Injury Prevention Center, University of Minnesota, 2003.

Gerberich SG, Gibson RW, French LR, Renier CM, Lee T-Y, Carr WP, Shutske J: Injuries among farm children and youth in farm households: Regional Rural Injury Study – I (RRIS–I). *Injury Prevention*, 7: 117-122, 2001.

Gerberich SG, Alexander BH, Church TR, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR: *Regional Rural Injury Study – II, Phase 2: Agricultural Injury Surveillance.* A report to the Centers for Disease Control and Prevention. Minneapolis: Regional Injury Prevention Center, University of Minnesota, 2004.

Goldcamp M, Hendricks KJ, Myers JR: Farm fatalities to youth 1995-2000: A comparison by age groups. *Journal of Safety Research*, 35: 151-157, 2004.

Gunderson PD, Gerberich SG, Gibson RW, Melton LJ III, French LR, Renier C, Erdman AG, True JA, Carr P, Elkington JM: An analysis of variables potentially associated with trauma in the agricultural community. *Proceedings: First World Conference on Accident and Injury Prevention.* Stockholm, Sweden. September, 1989.

Gunderson PD, Gerberich SG, Gibson RW, Adlis S, Carr WP, Erdman AG, Elkington JM, French LR, Melton LJ III, True J: Injury surveillance in agriculture. *American Journal of Industrial Medicine*, 18: 169-178, 1990.

Hagel BE, Fick GH, Meeuwisse WH: Injury risk in men's Canada West University football. *American Journal of Epidemiology*, 157(9): 825-833, 2003.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Hansen CP: A causal model of the relationship among accidents, biodata, personality and cognitive factors. *Journal of Applied Psychology*, 74(1): 81-90, 1989.

Hartling L, Brison RJ, Crumley ET, Klassen TP, Pickett W: A systematic review of interventions to prevent childhood farm injuries. *Pediatrics*, 114(4):e483-496, 2004.

Hendricks KJ, Layne LA, Goldcamp EM, Myers JR: Injuries to youth living on U.S. farms in 2001 with comparison to 1998. *Journal of Agromedicine*, 10(4): 19-26, 2005.

Jaquess DL, Finney JW: Previous injuries and behavior problems predict children's injuries. *Journal of Pediatric Psychology*, 19(1): 79-89, 1994.

Johnston BD, Grossman DC, Thompson RS: Transient elevation in risk of injury in siblings following injury encounters. *Journal of Pediatrics*, 142(1): 79-83, 2003.

Johnston BD, Grossman DC, Connell FA, Koepsell TD: High-risk periods for childhood injury among siblings. *Pediatrics*, 105(3part1): 562-568, 2000.

Kelsey TW: The agrarian myth and policy responses to farm safety. *American Journal of Public Health*, 84(7): 1171-1177, 1994.

Kendrick D, Marsh P: Injury prevention programmes in primary care: a high risk group or a whole population approach? *Injury Prevention*, 3(3):170-175, 1997.

Keogh JP, Nuwayhid I, Gordon JL, Gucer PW. The impact of occupational injury on injured worker and family: outcomes of upper extremity cumulative trauma disorders in Maryland workers. *American Journal of Industrial Medicine*, 38: 498-506, 2000.

Kim J, Zepeda L. Factors affecting children's participation and amount of labor on family farms. *Journal of Safety Research*, 35(4): 391-401, 2004.

Lam LT, Yang L, Zheng Y, Ruan C, Lei Zhenlain: Attention deficit and hyperactivity disorder tendency and unintentional injury among adolescents in China. *Accident Analysis and Prevention*, in press, 2006.

Langley J, McGee R, Silva P, Williams S: Child behavior and accidents. *Journal of Pediatric Psychology*, 8(2): 181-189, 1983.

Layde PM, Stueland DT, Nordstrom DL: Representativeness of trauma center registries for farm injury surveillance. *Accident Analysis and Prevention*, 28(5): 581-586, 1996.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Lee T-Y, Gerberich SG, Gibson RW, Carr WP, Shutske J, Renier CM: A population-based study of tractor-related injuries: Regional Rural Injury Study - I (RRIS - I). *Journal of Occupational and Environmental Medicine*, 38(8): 782-793, 1996.

Lee BC, Jenkins LS, Westaby JD: Factors influencing exposure of children to major hazards on family farms. *Journal of Rural Health*, 13(3) 206-215, 1997.

Leigh JP, Marcin JP, Miller TR: An estimate of the US Government's undercount of non fatal occupational injuries. *Journal of Occupational and Environmental Medicine*, 46(1): 10-18, 2004.

Leigh JP, McCurdy SA, Schenker MB: Costs of occupational injuries in agriculture. *Public Health Reports*, 116: 235-248, 2001.

Leigh JP, Markowitz SB, Fahs M, Landrigan PJ: *Costs of Occupational Injuries and Illnesses*. Ann Arbor (MI): University of Michigan Press; 2000.

Lewis MQ, Sprince NL, Burmeister LF, Whitten PS, Torner JC, Zwerling C: Work-related injuries among Iowa farm operators: an analysis of the Iowa Farm Family Health and Hazard Surveillance Project. *American Journal of Industrial Medicine*, 33(5): 510-517, 1998.

Lewis TL, DiLillo D, Peterson L: Parental beliefs about the developmental benefits of unintentional childhood injuries. *American Journal of Health Behavior*, 28: 861-868, 2004.

Linn JG, Husaini BA: Determinants of psychological depression and coping behaviors of Tennessee farm residents. *Journal of Community Psychology*, 15(4): 503-512, 1987.

Low JM, Griffith GR, Alston CL: Australian farm work injuries: Incidence, diversity and personal risk factors. *Australian Journal of Rural Health*, 4(3): 179-89, 1996.

Lyman S, McGwin G Jr, Enochs R, Roseman JM: History of agricultural injury among farmers in Alabama and Mississippi: prevalence, characteristics, and associated factors. *American Journal of Industrial Medicine*, 35(5): 499-510, 1999.

Madden C, Garrett JM, Cole TB, Runge JW, Porter CQ: The urban epidemiology of recurrent injury: beyond age, race, and gender stereotypes. *Academic Emergency Medicine*, 4(8): 772-775, 1997.

Manheimer DI, Mellinger GD: Personality characteristics of the child accident repeater.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Child Development, 38(2): 491-513, 1967.

Marlenga B, Pickett W, Berg RL: Evaluation of an enhanced approach to the dissemination of the North American Guidelines for Children's Agricultural Tasks: A randomized controlled trial. *Preventive Medicine*, 35(2): 15-159, 2002.

Marlenga B, Brison RJ, Berg RL, Zentner J, Linneman J, Pickett W: Evaluation of the North American Guidelines for Children's Agricultural Tasks using a case series of injuries. *Injury Prevention*, 10(69): 350-357, 2004a.

Marlenga B, Pickett W, Berg RL, Murphy D: Operational characteristics of tractors driven by children on farms in the United States and Canada. *Journal of Agricultural Safety and Health*, 10(1): 17-25, 2004b.

Matheny AP, Brown AM, Wilson RS: Behavioral antecedents of accidental injuries in early childhood: A study of twins. *The Journal of Pediatrics*, 79(1): 122-124, 1971.

McGwin G Jr, Scotten S, Aranas A, Enochs R, Roseman JM: The impact of agricultural injury on farm owners and workers in Alabama and Mississippi. *American Journal of Industrial Medicine*, 37(4): 374-381, 2000.

Melton LJ III: *History of the Rochester Epidemiology Project.* Mayo Clinic Proceedings, 71(3): 266-74, 1996.

Morrongiello BA: Children's perspectives on injury and close-call experiences: Sex differences in injury-outcome processes. *Journal of Pediatric Psychology*, 22: 499-512, 1997.

Morrongiello BA, Corbett M, McCourt M, Johnston N: Understanding Unintentional Injury Risk in Young Children II. The Contribution of Caregiver Supervision, Child Attributes, and Parent Attributes. *Journal of Pediatric Psychology*, 31(6): 540-551, 2006.

Morrongiello BA, House K: Measuring parent attributes and supervision behaviors relevant to child injury risk: examining the usefulness of questionnaire measures. *Injury Prevention*, 10: 114-118, 2004.

Morrongiello BA, Kiriakou S: Mothers' home-safety practices for preventing six types of childhood injuries: What do they do, and why? *Journal of Pediatric Psychology*, 29: 285-297, 2004.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Morrongiello BA, Midgett C, Shields R: Don't run with scissors: Young children's knowledge of home safety rules. *Journal of Pediatric Psychology*, 26(2): 105-115, 2001.

Munshi K, Parker DL, Bannerman-Thompson H, Merchant D: Causes, nature, and outcomes of work-related injuries to adolescents working at farm and non-farm jobs in rural Minnesota. *American Journal of Industrial Medicine*, 42(2): 142-149, 2002.

Murphy DJ: *Safety and health for production agriculture*. St. Joseph, Mich.: American Society of Agricultural Engineers, 1990.

Myers ML, Cole HP, Westneat SC: Cost-effectiveness of a ROPS retrofit education campaign. *Journal of Agricultural Safety and Health*, 10(2): 77-90, 2004.

Myers JR, Hard DL: Work-related fatalities in the agricultural production and services sectors, 1980-1989. *America Journal of Industrial Medicine*, 27: 51-63. 1995.

Myers JR, Hendricks KJ: *Injuries among youth on farms in the United States, 1998*. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (NIOSH publication no. 2001-154). Cincinatti (OH); 2001.

National Research Council, Institute of Medicine. *Protecting youth at work: Health, safety, and development of working children and adolescents in the United States*. Washington DC: National Academy Press, 1998.

National Safety Council: *Injury Facts, 2005-2006 Edition*. Itasca, IL: National Safety Council, 2006.

Nordstrom DL, Layde PM, Olson KA, Stueland D, Brand L, Follen MA: Incidence of farm-work-related acute injury in a defined population. *American Journal of Industrial Medicine*, 28: 551-564, 1995.

Nordstrom DL, Zwerling C, Stromquist AM, Murmeister LF, Merchant JA: Epidemiology of unintentional adult injury in a rural population. *Journal of Trauma*, 51(4): 758-766, 2001.

Norris FH, Matthews BA, Riad JK: Characterological, situational, and behavioral risk factors for motor vehicle accidents: A prospective examination. *Accident Analysis and Prevention*, 32(4): 505-515, 2000.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Parker DL, Merchant D, Munshi K: Adolescent work patterns and work-related injury incidence in rural Minnesota. *American Journal of Industrial Medicine*, 42: 134-141, 2002.

Parker D: *Enhancing agricultural safety and health through education*. National Institute for Occupational Safety and Health Extramural Award R01-OH-00-001 (award 1 R01 CCR514360-01). Accessed May 31, 2005 at: www.cdc.gov/niosh/childag/ CCR514360-01.html, 2000.

Peele PB, Tollerud DJ: Depression and occupational injury: Results of a pilot investigation. *Journal of Occupational and Environmental Medicine*, 47(4): 424-427, 2005.

Peterson L, Stern BL: Family processes and child risk for injury. *Behavior Research and Therapy*, 35(3): 179-190, 1997.

Pickett W, Brison RJ, Berg, RL, Zentner J, Linneman, J, Marlenga B: Pediatric farm injuries involving non-working children injured by a farm work hazard: five priorities for primary prevention. *Injury Prevention*, 11: 6-11, 2005.

Pickett W, Hartling L, Brison RJ, Guernsey JR: Fatal work-related farm injuries in Canada, 1991-1995. Canadian Agricultural Injury Surveillance Program. *Canadian Medical Association Journal*, 160(13): 1843-1848, 1999.

Pickett W, Hartling L, Dimich-Ward H, Guernsey JR, Hagel L, Voaklander DC, Brison RJ: Surveillance of hospitalized farm injuries in Canada. *Injury Prevention*, 7:123-128, 2001.

Pratt DS, Marvel LH, Darrow D, Stallones L, May JJ, Jenkins PL: The dangers of dairy farming: The injury experience of 600 workers followed for two years. *American Journal of Industrial Medicine*, 21(5): 637-50, 1992.

Pulkkinen L: Behavioral precursors to accidents and resulting physical impairment. *Child Development*, 66: 1660-1679, 1995.

Rasmussen K, Carstensen O, Lauritsen JM: Incidence of unintentional injuries in farming based on one year of weekly registration on Danish farms. *American Journal of Industrial Medicine*, 38(1): 82-89, 2000.

Rautiainen RH, Lange JL, Hodne CJ, Schneiders S, Donham KJ: Injuries in the Iowa

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Certified Safe Farm Study. *Journal of Agricultural Safety and Health*, 10(1): 51-63, 2004.

Reed DB, Kidd PS: Collaboration between nurses and agricultural teachers to prevent adolescent agricultural injuries: the Agricultural Disability Awareness and Risk Education Model. *Public Health Nursing*, 21(4): 323-330, 2004.

Rivara FP: Fatal and nonfatal farm injuries to children and adolescents in the United States, 1990-1993. *Injury Prevention*, 3: 190-194, 1997.

Rivara FP, Calonge N, Thompson RS: Population-based study of unintentional injury incidence and impact during childhood. *American Journal of Public Health*, 79: 990-994, 1989.

Robertson LS: *Injury Epidemiology: Research and control strategies.* Second Edition, New York: Oxford University Press, 1998.

Rosen BN, Peterson L: Gender differences in children's outdoor play injuries: A review and an integration. *Clinical Psychology Review*, 10(2): 187-205, 1990.

Rowe R, Maughan B, Goodman R: Childhood psychiatric disorder and unintentional injury: Findings from a national cohort study. *Journal of Pediatric Psychology*, 29(2): 119-130, 2004.

Ryb GE, Dischinger PC, Kufera J, Read KM: Risk perception and impulsivity: Association with risky behaviors and substance abuse disorders. *Accident Analysis and Prevention*, 38(3): 567-573, 2006.

Salmi LR, Weiss HB, Peterson PL, Spengler RF, Sattin RW, Anderson HA: Fatal farm injuries among young children. *Pediatrics*, 83(2): 267-271, 1989.

Salminen S, Heiskanen M: Correlations between traffic, occupational, sports, and home accidents. *Accident Analysis and Prevention*, 29(1): 33-36, 1997.

Saudino KJ, Ronald A, Plomin R: The etiology of behavior problems in 7-year-old twins: Substantial genetic influence and negligible shared environmental influence for parent ratings and ratings by same and different teachers. *Journal of Abnormal Child Psychology*, 33(1): 113-130, 2005.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Scarth R, Stallones L, Zwerling C, Burmeister L: The prevalence of depressive symptoms and risk factors among Iowa and Colorado farmers. *American Journal of Industrial Medicine*, 37(4): 382-389, 2000.

Scheidt PC, Harel Y, Trumble AC, Jones DH, Overpeck MD, Bijur PE: The epidemiology of nonfatal injuries among U.S. children and youth. *American Journal of Public Health*, 85(7): 932-937, 1995.

Schulman MD, Evensen CT, Runyan CW, Cohen LR, Dunn KA: Farm work is dangerous for teens: agricultural hazards and injuries among North Carolina teens. *Journal of Rural Health*, 13(4): 295-305, 1997.

Schneider GA, Bigelow C, Amoroso PJ: Evaluating risk of re-injury among 1214 army airborne soldiers using a stratified survival model. *American Journal of Preventive Medicine*, 18(3S): 156-163, 2000.

Schwebel DC: The role of impulsivity in children's estimation of physical ability: Implications for children's unintentional injury risk. *American Journal of Orthopsychiatry*, 74(4): 584-588, 2004.

Schwebel DC, Plumert JM: Longitudinal and concurrent relations among temperament, ability estimation, and injury proneness. *Child Development*, 70(3): 700-712, 1999.

Shannon A, Bashaw B, Lewis J, Feldman W: Nonfatal childhood injuries: A survey at the Children's Hospital of Eastern Ontario. *Canadian Medical Association Journal*, 146: 361-365, 1992.

Slap GB, Chaudhuri S, Vorters DF: Risk factors for injury during adolescence. *Journal of Adolescent Health*, 12(3): 263-268, 1991.

Spady DW, Saunders DL, Schopflocher DP, Svenson LW: Patterns of injury in children: A population-based approach. *Pediatrics*, 113(3): 522-529, 2004.

Sprince NL, Zwerling C, Lynch CF, Whitten PS, Thu K, Logsden-Sackett N, Burmeister LF, Sandler DP, Alavanja MC: Risk factors for agricultural injury: a case-control analysis of Iowa farmers in the Agricultural Health Study. *Journal of Agricultural Safety and Health*, 9(1): 5-18, 2003.

Springfeldt B, Thorsen J, Lee BC: Sweden's thirty-year experience with tractor rollovers. *Journal of Agricultural Safety and Health*, 4(3): 173-180, 1998.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Stallones L: Fatal unintentional injuries among Kentucky farm children: 1979 to 1985. *Journal of Rural Health*, 5: 246-256, 1989.

Stallones L: Surveillance of fatal and non-fatal injuries in Kentucky. *American Journal of Industrial Medicine*, 18: 223-234, 1990.

Stallones L, Beseler C: Farm work practices and farm injuries in Colorado. *Injury Prevention*, 9(3): 241-244, 2003.

Stallones L, Leff M, Garrett C, Criswell L, Gillan T: Depressive symptoms among Colorado farmers. *Journal of Agricultural Safety and Health*, 1(1): 37-43, 1995.

Stallones L, Keefe TJ, Xiang HY: Characteristics associated with increased farm work-related injuries among male resident farm operators in Colorado, 1993. *Journal of Agricultural Safety and Health*, 3(3): 195-201, 1997.

Stueland D, Lee B, Layde PM: Surveillance of agricultural injuries in Central Wisconsin: Epidemiologic characteristics. *Journal of Rural Health*, 78(1): 63-71, 1991.

Stueland DT, Nordstrom DL, Layde PM, Follen MA, Olson KA, Brand LM, Gunderson PD: Case control study of agricultural injuries to older farmers in central Wisconsin. *Journal of the American Geriatric Society*, 44(4): 475-476, 1996.

Stueland DR, Lee BC, Nordstrom DL, Layde PM, Wittman LM, Gunderson PD: Case-control study of agricultural injuries to women in central Wisconsin. *Women and Health*, 25(4): 91-103, 1997.

Sutherland VJ, Cooper CL: Personality, stress, and accident involvement in the offshore oil and gas industry. *Personality and Individual Differences*, 12: 195-204, 1991.

Taubman – Ben-Ari O, Mikulincer M, Gillath, O: From parents to children – similarity in parents and offspring driving styles. *Transportation Research Part F*, 8: 19-29, 2005.

Thelin A: Fatalities in farming and forestry: an examination of the registry information used in the Swedish national statistics, 1988-1997. *Journal of Agricultural Safety and Health*, 8(3): 289-295, 2002.

Tiesman HM, Peek-Asa C, Whitten P, Sprince NL, Stromquist A, Zwerling C: Depressive symptoms as a risk factor for unintentional injury: A cohort study in a rural county. *Injury Prevention*, 12: 172-177, 2006.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

US Department of Labor: *Child Labor Requirements in Agriculture under the Fair Labor Standards Act. Child Labor Bulletin No. 102.* Washington, D.C.: US Department of Labor, Employment Standards Administration, Wage and Hour Division. WH Publication 1295. US Government Printing Office: 1989-241-406/06551, 1984.

US Department of Labor, Bureau of Labor Statistics: *Workplace injuries and illnesses in 2004.* USDL 05-2195. Accessed 06/06 at http://www.bls.gov/iif/oshwc/osh/os/osnr0023.pdf, 2005.

US Department of Labor, Occupational Safety and Health Administration: *Laws, Regulations, and Interpretations.* Accessed 08/06 at http://www.osha.gov/comp-links.html, 2006.

Wazana A: Are there injury-prone children? A critical review of the literature. *Canadian Journal of Psychiatry*, 42(6): 602-610, 1997.

Weller NF, Cooper SP, Tortolero SR, Kelder SH, Hassan S: Work-related injury among South Texas Middle School Students: Prevalence and Patterns. *Southern Medical Journal*, 96(12): 1213-1220, 2003.

Welsch A, Gerberich SG, Gunderson PD: *A unique approach to surveillance of severe and catastrophic injuries: An agricultural case study.* Proceedings: Public Health Conference on Records and Statistics, National Center for Health Statistics, USDHHS, PHS, CDC, July 1989; pp. 474-480.

White HR, Johnson V, Buyske S: Parental modeling and parenting behavior effects on offspring alcohol and cigarette use – a growth curve analysis. *Journal of Substance Abuse*, 12: 287-210, 2000.

Wickrama KAS, Conger RD, Wallace LE, Elder GH Jr: The intergenerational transmission of health-risk behaviors: Adolescent lifestyles and gender moderating effects. *Journal of Health and Social behavior*, 40: 258-272, 1999.

Wilk VA: Health hazards to children in agriculture. *American Journal of Industrial Medicine*, 24: 283-290, 1993.

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TABLE 1

Summary of Literature Pertinent to Potential Risk Factors for Children's Injury*

Authors	Year	Purpose	Population	Methods	Findings
Cameron CM, Purdie DM, Kliewer EV, et al.	2006	To determine the association between injury and post-morbid mental health	Residents of Manitoba, Canada, 18-64 years, from 1988-1991	Retrospective cohort study and multivariable logistic regression	Injured participants had increased rates of mental health service use for pre-injury year and every year through ten-year follow-up
Lam LT, Yang L, Zheng Y, et al.	2006	To identify the association between ADHD tendency and risk of injury	1,429 children, 13-17 years, in China in 2005	Cross-sectional survey and multivariable logistic regression	Children with high ADHD tendency were at greater risk of self-reported injury than children with low tendency
Morrongiello B, Corbett M, McCourt M, et al.	2006	To examine child and parent attributes and their relation to supervision & injury	62 mothers of children, 2-5 years of age, for a 3-month period in Canada	Cross-sectional surveys of mothers and multiple linear regression analyses	Child /parent attributes associated with supervision and injury risk; parental supervision associated with medically attended injuries
Tiesman HM, Peek-Asa C, Whitten P, et al.	2006	To examine relations between depressive symptoms and unintentional injury	1,493 rural county residents, >18 years of age, between 1999 & 2004	Prospective cohort study and multivariable Poisson regression	Depressive symptoms were a risk factor for injury after controlling for medication, gender, prior injury, income, and sleepiness
Ryb GE,	2006	To explore relations	756 blunt trauma	Cross-sectional	Low risk perception and high

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Authors	Year	Purpose	Population	Methods	Findings
Dischinger PC, Kufera JA, et al.		of risk perception, impulsivity, and risky behaviors	patients in MD, 18 years or older, in 1994 & 1995	hospital interviews and multivariable logistic regression	impulsivity were associated with risky behaviors at bivariate and multivariable levels
Peele PB, Tollerud DJ	2005	To explore relations between occupational injury and depression	261 patients of occupational health clinics in Pittsburgh, PA in 2001 & 2002	Clinic-based case-control survey and multivariable logistic regression	No association between depression and occupational injury, although injured women more likely to have higher depression scores
Rowe R, Maughan B, Goodman R	2004	To examine relations of child psychiatric disorders and unintentional injury	10,438 children, five to fifteen years of age, in Britain during 1999	Cross-sectional survey and multivariable logistic regression	Diagnosed ADHD, depression, and anxiety each related to distinct injury types (i.e. hospitalized vs. non-hospitalized or treated)
Schwebel DC	2004	To identify relations of overestimation of physical ability and impulsivity	57 recruited children, 6 years, in a Southern US city (specific dates not noted)	Convenience sample, cross-sectional study and bivariate analyses	No differences in ability estimation with and without forced decision latency; overestimation of ability associated with injury risk
Chliaoutakis, Demakakos, Tzamalouka G, et al.	2002	To examine associations between aggressive driving and car crashes	356 drivers, 18-24 years, in Greece (specific dates not noted)	Cross-sectional study, PCA, and multivariable logistic regression	Driving violations and irritability were factors relevant to aggressive driving; joyriding and irritability associated with car crashes

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Authors	Year	Purpose	Population	Methods	Findings
Dowd MD, Keenan HT, Bratton SL	2002	To synthesize the epidemiologic literature pertinent to children's injuries	Literature on injury epidemiology, interventions, costs, and consequences	Review of injury prevention science and relevant literature	Leading causes of children's injuries are motor vehicle crashes, drowning/submersion, homicides, suicides, and fires
Norris FH, Matthews A, Riad JK	2000	To identify risk factors for motor vehicle crashes	500 drivers, 19-88 years, in 4 southern US cities between 1991-1995	Purposive sample, multivariable logistic regression of prospective data	Age, high hostility combined with poor self-esteem, and tendencies to disobey traffic rules associated with crash risk
Schwebel DC, Plumert JM	1999	To identify relations of temperament, ability estimation, and injury proneness	29 girls and 30 boys, 33, 46, & 76 months, in Eastern Iowa (dates not noted)	Longitudinal recruited cohort, multiple linear regression	High extraversion and low inhibitory control associated with overestimation of physical abilities and more unintentional injury
Frone MR	1998	To examine risk factors for occupational injury among children	319 children, 16-19 years, working for pay in NY in 1996 (convenience sample)	Cross-sectional survey, hierarchical linear regression analyses	Gender, negative affectivity, exposure to physical hazards, on-the-job substance abuse associated with work injury
Caspi A, Harrington H, Moffitt TE,	1997	To explore relations of child personality types and high-risk	Birth cohort of 1,037, born between 1972 & 1973, in New	Prospective cohort study and multiple linear regression	Undercontrol and confidence associated with risk behaviors; aggression and low constraint

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Authors	Year	Purpose	Population	Methods	Findings
et al.		young adult behavior	Zealand	analyses	related to alcohol dependence
Morrongiello BA	1997	To determine difference by genders in perspectives of near-misses & injury	60 children & parents interviewed daily for 14 days (dates & sites not noted)	Cross-sectional telephone surveys and qualitative content analyses	Boys reported more injuries and near-misses; boys tended to repeat behaviors that associated with previous injuries
Wazana A	1997	To review the literature pertaining to children's risk factors for injury	11 general child injury studies and 6 child pedestrian injury studies	3 literature reviews, limiting studies to those with analysis of risk factors	Aggression was a consistent risk factor for general injuries; hyperactivity inconsistently associated with all injury types
Farmer JE, Petersen L	1995	To identify risk factors for injury among children with ADHD	30 Caucasian boys, 7-11 years, in Missouri (specific dates unknown)	Case-control study and bivariate, descriptive analyses	ADHD children anticipated less severe consequences of risk behavior and used fewer prevention measures
Pulkkinen L	1995	To identify emotional and behavioral determinants of children's injury	147 males and 142 females, 8, 14, and 27 years of age, in Finland	Prospective cohort study and multivariable logisitc regression	Childhood noncompliance associated with injury; aggression and conduct problems associated with male impairment
Scheidt PC, Harel, Y,	1995	To determine accurate childhood	17,110 children, zero to seventeen years of	Cross-sectional study (NHIS) and	Boys experienced higher rates of injury than girls; adolescents

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Authors	Year	Purpose	Population	Methods	Findings
Trumble AC, et al.		injury morbidity estimates	age, across the US during 1988	adjusted bivariate analyses	experienced highest overall rate and proportion of serious injuries
Jaquess DL, Finney JW	1994	To identify risk factors for children's unintentional injury	50 low SES children from summer day camps (time and location unknown)	Prospective cohort study and multiple linear regression analyses	Previous medically-treated injuries, opposition scores, and injury at day camp associated with injuries in year after camp
Barkley RA, Guevremont, Anastopoulos AD, et al.	1993	To identify relations between ADHD, motor vehicle citations, and crashes	71 subjects, sixteen to twenty-two years of age, during 1987 & 1989 in MA	Prospective cohort study and multiple logistic regression analyses	ADHD subjects had more crashes, sustained more injuries, and were at fault for more crashes than control subjects
Davidson LL, Taylor EA, Sandberg ST, et al.	1992	To determine whether hyperactive boys were at greater risk of unintentional injury	1,296 boys, ages 6-8, in a London community (specific dates unknown)	Prospective cohort study with 16-month follow-up; bivariate analyses	No relation between hyperactivity and injury, and no relation between hyperactivity and severe injuries, was observed
Shannon A, Bashaw B, Lewis J, et al.	1992	To examine types and severity of ED-treated injuries among children	2,886 children <18 years of age in Eastern Ontario over 1984-1985	Retrospective exam of medical charts and bivariate analyses	More boys than girls treated; falls and sports-related injuries most common; motor-vehicle crashes associated with hospitalization
Sutherland	1991	To examine relations	360 workers of off-	Prospective cohort	Type A personalities and

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Authors	Year	Purpose	Population	Methods	Findings
and Cooper		in stress, personality, and injury frequency	shore oil drilling rigs (site/time not noted)	study with bivariate analyses	neuroticism were associated with frequency of injury events
Rosen BN, Peterson L	1990	To review literature on children's injury rates and behaviors	Epidemiologic and psychology literature on children's injury	Review and synthesis of existing literature	Boys more likely to experience injuries and be involved in behaviors correlated with injury
Hansen CP	1989	To construct a causal model of the process of industrial injury	362 chemical industry workers, 21-62 years, 1979-1984	Cross-sectional study and structural equation modeling	Social maladjustment and distractibility found to be associated with risk of injury
Rivara FP, Calonge N, Thompson RS	1989	To identify incidence and impact of unintentional injuries among children	1,225 injuries in an HMO population, 19 years of age or younger, in WA	Prospective sampling from medical records; bivariate analyses	Highest rates of injuries due to falls, sports and recreation; 56% of injuries resulted in restricted activities for child
Davidson LL, Hughes SJ, O'Connor PA	1988	To determine association between behavior disorders and risk of injury	951 children, 5-8 years, in South Wales (specific dates unknown)	Prospective data collection from birth cohort and bivariate analyses	Injury risk associated with boys and discipline problems; no association with overactive behavior, decreased concentration
Davidson LL	1987	To review literature on hyperactivity, antisocial behavior,	13 studies of behavior problems and risk of injury	Critical review of the literature specific to	No consistent association between hyperactivity and injury; aggressive behavior and injury do

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Authors	Year	Purpose	Population	Methods	Findings
		and children's injury	among children	prospective studies	appear to be associated
Bijur, Stewart Brown S, Butler N	1986	To identify social and behavioral risk factors for injuries	11,966 children, age 5 years, in Britain during 1975	Surveys of a birth cohort and multiple linear regression	Associations between aggression and all injury types; overactivity and non-hospitalized injuries
Langley J, McGee R, Silva P, et al.	1983	To identify associations between children's behavior and risk of injury	954 children, age 7 years, in Dunedin birth cohort in late 1970s	Parent and teacher assessment of behavior and bivariate analyses	Observed association between injury events and antisocial behavior; parental discipline associated with injury events
Matheny AP, Brown AM, Wilson RS	1971	To identify behavioral predictors of children's injury	49 same-sex twin pairs (dates and locations not noted)	Longitudinal twin birth cohort and bivariate analyses	Twins with more injuries were more active, temperamental, and less attentive than co-twins
Manheimer DI, Mellinger GD	1967	To identify behaviors among children with varying levels of injury liability	684 boys and girls, aged 4-18, in CA (specific dates not noted)	Cross-sectional survey of medical records and bivariate analyses	Associations between extraversion, poor discipline, aggressiveness, and impulsivity and injury liability observed

* Matrix adapted from Garrard, 2004.

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TABLE 2

Summary of Literature Examining Children's Agricultural Injury*

Authors	Year	Purpose	Population	Methods	Findings
Carlson KF, Langner DM, Alexander BH, et al.	2006	To examine injury associations between parents and their children	958 children, ≤19 years of age, in five-state Midwestern region of US in 1999	Prospective cohort, case-control study, and multivariable logistic regression	Fathers' injuries and mothers' injuries associated with children's risk; children with both parents injured at four-times greater risk
Carlson KF, Gerberich SG, Church TR, et al.	2005	To describe incidence and identify risk factors for tractor-related injuries	3,765 agricultural households in five Midwestern US states over 1999	Prospective cohort study and multivariable logistic regression	Children <5, 5-9, 10-14, 15-19, and 20-24 years at decreased risk compared to adults 35-44 years; males at higher risk than females
Pickett W, Brison RJ, Berg RL, et al.	2005	To examine agricultural injuries to children not engaged in tasks	370 children, <18 years of age, in Alberta & Ontario, Canada in 1990-2001	Secondary analysis of case series data and bivariate analyses	Most children were residents of farm families; 63% <7 years old; leading sources were bystander and passenger runovers
Saudino KJ, Ronald A, Plomin R	2005	To examine genetic influence on children's behaviors	3,714 twin pairs, age 7, in 2001-2002 in England and Wales	Birth cohort study and hierarchical regression analyses	Some evidence of greater heritability of behavior traits among boys
Taubman BAO,	2005	To examine parents	475 adult members of	Cross-sectional	Associations found between

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Authors	Year	Purpose	Population	Methods	Findings
Mikulincer M, Gillath O		and adult children's driving styles	174 families in Israel (dates not noted)	survey and bivariate analyses	fathers' and sons' and mothers' and daughters' driving styles
Dimich-Ward H, Guernsey JR, Pickett W, et al.	2004	To identify patterns in occurrence and sources of farm injuries by gender	655 fatal injuries and 8,263 hospitalized injuries, all ages, in Canada in 1990-1996	Examination of CAISP medical records data and stratified analyses	Eleven times more fatal injuries among males than females; most common sources were rollover for males and runover for females
Spady DW, Saunders DL, Schopflocher DP, et al.	2004	To describe frequency and patterns of children's injury	96,359 children 0-10 years living in Alberta, Canada in 1985-1988	Population-based longitudinal study and bivariate analyses	Repeat injuries sustained by 73% of population; all injuries were more common among boys than among girls
Browning SR, Westneat SC, Donnelly C, Et al.	2003	To identify children's exposures to tasks and 1-yr. cumulative injury incidence	999 Children, 18 years and younger, living on family farms in KY (dates not noted)	Cross-sectional, two stage cluster design, bivariate analyses	Boys 16-18 years of age had highest injury rate; machinery, cattle and horses, falls from heights common sources of injury
Hagel BE, Fick GH, Meeuwisse WH	2003	To identify risk factors for injury among football players	Varsity men's football players in Canada during 1993-1997	Prospective cohort study and multivariable Poisson regression	Past injury was a risk factor for subsequent injury, as were years of participation in football

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Authors	Year	Purpose	Population	Methods	Findings
Johnston BD, Grossman D, Thompson RS	2003	To examine patterns of injury risk within sibling groups	16,335 children, 0-15 years, enrolled in an HMO in 1995-1997	Prospective cohort and multivariable Cox hazard ratios	Risk of injury greater for children with recent sibling injury; higher risk when minor injuries excluded
Sprince NL, Zwerling C, Lynch CF, et al.	2003	To analyze risk factors for agricultural injury	6,999 adult farmers living in Iowa during 1998	Case-control study with multivariable logistic regression	Injury associated with weekly work hours, large livestock, regular medication use, and age
Emery CA, Meeuwisse WH	2001	To identify risk factors for groin injuries among hockey players	1,292 NHL players (inclusive sample), training camps in 98-99 (sites not noted)	Prospective cohort study and multivariable logistic regression	Players with previous history of groin injury were two times more likely to sustain a second hockey-related groin injury
Ferguson SA, Williams AF, Chapline JF, et al.	2001	To examine the influence of parents' driving patterns on those of their children	155,349 drivers, aged 18-21, and their parents in NC during 1991-1996	Examination of driver history files and multivariable logistic regression	Children's driving in first 3 years of licensing related to records of their parents, controlling for household type and gender
Gerberich SG, Gibson RW, French LR, et al.	2001	To identify incidence and risk factors for children's agricultural injuries	4,013 children <20 years of age in MN, ND, SD, WI, and NE during 1990	Cohort study with multivariable logistic regression analyses	Increased rates of injury observed among children who operated tractors, worked with dairy cattle, or were male.
Nordstrom DL,	2001	To describe incidence	1,644 adults from an	Cross-sectional	Overexertion and falls associated

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Authors	Year	Purpose	Population	Methods	Findings
Zwerling C, Stromquist AM, et al.		of and risk factors for adult injury in rural population	all-rural county in Iowa during 1994 through 1998	survey and multivariable logistic regression	with nearly half of injuries; women with high depressive symptoms at greater risk
Bancej C, Arbuckle T	2000	To evaluate pattern and risk factors for children's farm injury	1,765 family farms in Ontario, Canada over 1991 through 1992	Cross-sectional, multivariable logistic regression	Children 1-4 years and males had highest rates; gender and parent education associated risk factors
Johnston BD, Grossman D, Connell FA, et al.	2000	To examine potential associations in sibling injuries treated in a health system	41,242 child Medicaid recipients in WA during 1992 & 1993	Multivariable Cox regression survival analyses using medical records	Risk of ED visit greater for children with injured siblings in previous 90 days; risk peaked 4-10 days after sibling injury
McGwin G, Scotten S, Aranas A, et al.	2000	To compare injury consequences among white and black farm owners and workers	1,244 farmers, of all ages, living in AL and MS during 1994 through 1996	Prospective cohort study and bivariate analyses	Most injuries minor/moderate but required medical attention; black workers had more severe injuries; lost work frequent injury outcome
Rasmussen K, Carstensen O, Lauritsen JM	2000	To describe incidence of farming injuries on Danish operations	393 farms with 1,597 residents in Denmark in 1993-1994	Prospective cohort study and bivariate analyses	Over one-third of farm owners experience at least one injury; animal injuries most common
Schneider GA, Bigelow C,	2000	To identify risk factors for subsequent	1,214 US Army soldiers at Fort	Retrospective cohort study and	Risk of injury was seven times greater among previously injured

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Authors	Year	Purpose	Population	Methods	Findings
Amoroso PJ		injuries among service members	Bragg, NC, from 1994-1996	Cox proportional hazards modeling	service members; initial injury types were associated with risk
White HR, Johnson V, Buyske S	2000	To examine effect of parent modeling on children's high-risk behaviors	218 males and 214 females, age 15 at time 1 & 28 at time 2, in NJ, 1979-1994	Prospective cohort study and multivariable logistic regression	Parent drinking rather than behavior predicted heavy drinking by offspring; mothers' drinking more strongly associated
Pickett W, Hartling L, Brison RJ, et al.	1999	To describe fatal occupational injury incidence on farm/ranch operations	Canadians who died from work-related farm injuries between 1991 and 1995	Review of CAISP fatality data and bivariate rate calculations	Highest rates observed for men and elderly; leading sources were tractor rollovers, runovers, and entanglements in machinery
Wickrama KA, Conger RD, Wallace LE, et al.	1999	To determine if parents' health risk behaviors influence those of their children	330 adolescents, in 7th grade and with siblings, in rural IA during 1989-1994	Longitudinal cohort study with structural equation modeling	Parents health-risk lifestyles were associated with those of their children; fathers' affected sons' and mothers' affected daughters'
Browning SR, Westneat SC, Donnelly C, et al.	1998	To report agricultural tasks and one-year incidence of injury among children	999 children, <19 years, living on family farms in KY during 1994-1995	Cross-sectional, two-stage survey with bivariate analyses	Children most often involved in chores related to beef cattle and tobacco; boys 16-18 had highest injury rates
Gerberich SG,	1998	To identify	13,144 farm	Prospective cohort	Hours worked per week, operation

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Authors	Year	Purpose	Population	Methods	Findings
Gibson RW, French LR, et al.		magnitude of and risk factors for machinery injuries on farms	household members in 5-state Midwestern US region over 1990	study and multivariable logistic regression	of auger, field crops as primary enterprise, and male gender identified as risk factors for injury
Boyle D, Gerberich SG, Gibson R, et al.	1997	To identify risk factors for injury on dairy operations	255 persons, 5+ years, in 5-state US region over 1990	Prospective cohort and multivariable logistic regression	Milking, hours work per week, and trimming or treating hooves associated with injury risk
Kendrick D, Marsh P	1997	To identify risk factors for childhood unintentional injury and injury outcome	771 parents of health practice children in Nottingham, UK, during 1993	Prospective cohort study and multivariable logistic regression	Previous medically-attended injury was risk factor for injury-related clinic visits, emergency visits, and primary health care visits
Madden C, Garrett J, Cole T, et al.	1997	To determine if rates of injury vary by E-code or demographics	34,378 patients treated in an urban ED from 1991-1993	Prospective cohort and Cox proportion hazards modeling	Prior injury in year preceding study was best predictor of future ED treated injuries
Rivara FP	1997	To identify rates of children's injury and compare to prior rates	Children ≤19 injured on farming operations in US in 1990-1993	Database examination and bivariate analyses	Rate of deaths lower than prior rates; males injured more frequently than females
Salminen S, Heiskanen M	1997	To examine correlations in traffic, work, home, and	9,598, 13,762, & 4,275 Finnish, ages 14 and older, across	Cross-sectional telephone surveys and bivariate	Correlations between all injury types (traffic crashes, work injuries, and sports injuries) were

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Authors	Year	Purpose	Population	Methods	Findings
		sports injuries	1980, 1988, & 1993	analyses	observed
Schulman MD, Evensen CT, Runyan CW, et al.	1997	To identify hazard experience and injury for children working on farms	141 children, 14-17 years, in NC that worked on farming operations in 1995	Cross-sectional telephone survey and bivariate analyses	Gender, age, and experience related to types of exposure and types of injuries sustained; cuts, burns, and falls common injuries
Stallones L, Keefe TJ, Xiang HY	1997	To identify injury risk factors for off-farm paid work	470 male farm operators in Colorado in 1993	Cross-sectional, multivariable logistic regression	Number of days of off-farm employment, and large animals, associated with agricultural injury
Stueland DT, Lee BC, Nordstrom DL, et al.	1997	To identify risk factors for agricultural injury among females	40 injuries among women 18+ years living on farms in the MESA, WI	Case-control study and multivariable logistic regression analysis	Number of hours worked and presence of bulls associated with risk among women; cows primary source of injury in 43% of cases
Lee TY, Gerberich SG, Gibson RW, et al.	1996	To identify incidence of and risk factors for tractor injuries in agricultural popn.	13,144 farm household members in 5-state Midwestern US region over 1990	Prospective cohort study and multivariable regression analyses	Rates of injury increased with increased work hours; most events occurred while person was mounting or dismounting tractor
Low JM, Griffith GR, Alston, CL	1996	To identify incidence and risk factors for farm work injuries	Owners/managers of 919 farms in Australia, 1992-1993	Cross-sectional, generalized linear modeling	Animals primary source of injury; age, previous injury, BMI, sleep, and stress were risk factors

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Authors	Year	Purpose	Population	Methods	Findings
Stueland DT, Lee BC, Nordstrom DL	1996	To identify risk factors for children's agricultural injuries	162 child farm residents in MESA, WI in 1990-1992	Case-control study and multivariable logistic regression	Hours worked per week, presence of disabled safety device, and grazing cows were risk factors
Myers JR, Hard DL	1995	To describe work-related fatalities in agricultural industry	6,727 fatal injuries in US workers, age 16+, between 1980-1989	Review of NTOF data and bivariate analyses	Males, blacks, 65+ age group had highest rates of fatal injury; 16-24 male fatalities decreased over time
Nordstrom DL, Layde PM, Olson KA, et al.	1995	To identify incidence of agriculture-related work injuries	510 persons treated for injuries in MESA, WI in 1990-1992	Population-based, prospective study, bivariate analyses	Dairy farm residents, and adult males, had greatest risks of injury; animals most frequent source
Pratt DS, Marvel LH, Darrow D, et al.	1992	To identify incidence of injury on dairy operations	600 farmers/workers on 201 dairy farms in NY, 1984-1986	Prospective cohort study and bivariate analyses	Owner-operators incurred more frequent injuries; those working >60 hours/week had greatest rates
Cogbill TH, Steenlage ES, Landercasper MD, et al.	1991	To examine agriculture-related injury fatalities and disabilities	739 patients, all ages, treated in trauma center in WI over 1977-1989	Analysis of hospital trauma center charts and bivariate analyses	Most common injury sources were animals, falls, and machinery; nearly one-fourth of patients had continued disability due to injury
Slap GB, Chaudhuri S, Vorters DF	1991	To identify differences among severely injured vs.	Adolescents hospitalized for severe injury or	Cross-sectional surveys and multivariable	Severely injured more likely to have previous serious injuries; boys with previous stressful events

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Authors	Year	Purpose	Population	Methods	Findings
		ill adolescents	illness	logistic regression	more likely to be injured
Stueland D, Lee BC, Layde PM	1991	To describe incidence and patterns of agricultural injury among farmers	913 patients, all ages, treated for trauma in MESA, WI during 1986-1988	Bivariate analysis of medical records in farm trauma surveillance	Injuries most common among males and ages 19-65 years; falls were most common source among children under 16 years of age
Stallones L	1990	To examine mortality and morbidity data from national survey	Agricultural operations across KY in 1979-1985	Cross-sectional surveys and bivariate analyses	Equipment was source of nearly half of fatal injuries; injury rates higher for males than females
Cogbill TH, Busch Jr. HM, Stiers GR	1985	To define the scope of children's agricultural injuries	105 hospital-treated children, <19, across US in 1978-1984	Examination of hospital records, bivariate analyses	Animals, tractors, machinery, and falls most common sources; most severe from tractors/machinery

* Matrix adapted from Garrard, 2004.

CHAPTER III

RESEARCH DESIGN AND METHODS

Specific Aims

The goal of this research is to better understand the interplay of behavioral and environmental factors and their contribution to intra-familial patterns of agricultural injury. The specific aims of this dissertation were to: (1) Determine the association between children's behavioral traits and their risk of agricultural injury; (2) Identify associations between children's behavioral traits and their high-risk environmental exposures; and (3) Examine the association between parents' and children's agricultural injuries while controlling for pertinent shared behaviors and environmental exposures.

Overview

The study, herein, was based on combined data from the Regional Rural Injury Study – II (RRIS–II), Phase 1 and Phase 2 efforts (Gerberich et al., 2003; 2004). Phase 1 of the study involved data collection for 1999 and was designed to identify incidence and consequences of all types of injuries, among persons of all ages, and to determine critical risk factors for children's agricultural injuries in the five-state region of Minnesota, Wisconsin, North Dakota, South Dakota, and Nebraska (Gerberich et al., 2003). The 2001 Phase 2 effort was designed as a model for surveillance of agricultural injuries, enabling the monitoring for changes in incidence, consequences, and related risk factors (Gerberich et al., 2004).

Both phases involved comparable methods but distinct population samples. Full-length interviews with the eligible and participating households occurred in July of each study year, and January of the following year, to collect data for the respective prior six-month periods. Data collection provided information on the incidence, types, sources, and consequences of injuries while, through a nested case-control design, exposure data were collected to allow identification of agricultural injury risk factors among children less than 20 years of age (<20).

The 1999 and 2001 phases involved cohorts of 16,538 and 16,064 people, respectively; over half of these were children <20. The cohorts reported 2,586 and 2,459 injury events over the course of each study year, 2,318 (46%) of which were associated

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with their own agricultural operation-related activities. In 1999, there were 203 cases and 755 controls that participated in the case-control study (~3.7 controls per case), while, in 2001, 207 cases and 1,111 controls participated (~5.4 controls per case).

Based on prior analyses, demographic, exposure, and injury patterns were found to be comparable between populations in each study phase, thus justifying aggregation of the two data sets to address study aims.

Target Population

Study Cohort

According to the United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS), there were an estimated 270,600 agricultural operations in the participating states during 2001 (12.6% of farms and ranches, nationally) (USDA, 2004). The US Census Bureau estimated 477,320 persons to have been living on agricultural operations in this five-state region, based on the 2000 census (US Census Bureau, 2005). These states, collectively, represented a broad range of types of agricultural production and were among the leading agricultural producers in the nation (USDA, 2002).

The USDA NASS Master ListFrame of Farming Operations was used as the basis for sampling agricultural operations in both study phases. This database is managed comparably in each state throughout the US, and is representative of all agricultural operations. The two criteria for inclusion on the list were: annual sales of $\geq$\$1,000 dollars of agricultural products, and verification that the operation household was actively farming/ranching or was involved in a Conservation Reserve Program (CRP). The Master ListFrame is updated and maintained on a regular basis by individual state Agricultural Statistics Service offices through cross-checks with lists maintained by other agencies and through routine interview contacts, conducted once every three years by the Agricultural Statistics Service.

For each study period (1999 and 2001), random samples of 3,200 agricultural operations were selected for each state included (MN, WI, ND, SD, and NE), providing a total of 16,000 selected operations each year. To be eligible for participation, the agricultural operations had to: (1) have a household associated with the operation; (2)

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include children younger than 20 years of age (<20) in residence as of January 1st, 1999 or 2001; (3) produce at least $1,000 of agricultural goods in the year prior to each study, or be involved in a Conservation Reserve Program (CRP); and (4) be actively farming/ranching as of January 1st, 1999 or 2001. Participation in the study also involved willingness by the eligible households to complete two additional telephone interviews at six-month intervals.

A total of 4,402 (27.5%) of the farms/ranches were found to be eligible in 1999 and, of these, 3,765 (85.5%) participated in the full study. In 2001, 4,408 (27.5%) operations were found to be eligible and 3,655 (82.9%) participated in the full study. This generated cohorts of 16,538 and 16,064 agricultural household members, respectively, for each study year.

Cases

Cases were all agricultural injury events sustained by household members less than 20 years of age (<20) that were associated with their agricultural operation during the reporting periods. The injury had to be associated with the family's agricultural operation, whether a result of the child's work or chores relating to the operation, or incurred as a result of bystanding pertinent agriculture-related activities. Household members were anyone who was part of the household for any length of time during the study period, including students away at college, children who resided in multiple households, and those who moved out of the household or died, as long as they were in residence as of January 1st of each study year. Individual children could be involved in more than one case event, and injury cases from the same household were also considered independent events. Resulting hierarchical structure of the data was addressed in the analyses.

Cases were questioned about various exposures of interest during the calendar-month prior to the month of their injury event. Personal data collected included demographics such as gender, age, and race; number of hours worked per day/week/month; hours spent in school; illness/injury history; medication use; physical fitness (frequency/intensity per week); average hours of sleep; use of relevant personal protective equipment; education/training in specific activities and/or use of equipment;

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perception of risk; safety awareness; and relevant behavioral characteristics. Data collected pertinent to environmental exposures included acres in active production; type of agricultural operation; number of various types of animals present on the operation; number of various types of equipment in use; types of specific direct exposures (e.g., riding on/operating a tractor; working with a forage harvester, baler, or auger; working with beef cattle or dairy cattle, etc.); parent/guardian injury experience; parent/guardian perception of risk, safety awareness, and level of supervision; and socioeconomic status of the household.

Of 223 eligible case events for 1999, 203 participated, for a response proportion of 91%. In 2001, there were 209 eligible cases, with 207 participating (99%). Combined, there were a total of 410 cases for analysis.

Controls

The control populations came from households randomly sampled to achieve minimum ratios of three controls per case. To account for seasonal trends in injury incidence, injury rates from the most recent, similar study were used to estimate the number of controls needed: Phase 1 selection was based on data from the Regional Rural Injury Study – I (RRIS–I) (Gerberich et al., 1993) while Phase 2 selection was based on Phase 1 data. An incidence-density sampling scheme was used to sample from the agricultural injury-free person-time experience (months) of children <20 in residence on the operation. One child with at least one agricultural injury-free month was randomly selected from each sampled household. Data collected were comparable to those collected for case events. For the control's exposure experience, data were collected for the month before an agricultural injury-free month, sampled to reflect expected monthly incidence rates based on data from the most recent, comparable study. This sampling scheme allowed cases to be sampled as controls for months in which they did not sustain an agricultural injury. Children were also eligible to be selected as a control more than once.

There were 755 controls of 778 eligible that participated in 1999, for a response proportion of 97%. Of 1,147 eligible in 2001, 1,111 controls participated (97%). There

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were approximately 3.7 and 5.4 controls per case event in each study phase, respectively. The combined total control population was 1,866, a ratio of 4.6 per case event.

Data Collection

The current study was based on data collected during both phases (1999 and 2001) of the Regional Rural Injury Study – II (RRIS–II) (Gerberich et al., 2003; 2004). Data from each phase were combined for the current analyses.

Contact Procedures

Contact procedures were similar for both phases of the RRIS–II. Initial contact with the agricultural operations, selected for the study, was made after the first of January in each year (1999 and 2001). This consisted of an introductory mailing from both the study investigators and the USDA NASS offices in each respective state, followed by a brief screening interview by telephone. Interviews were attempted for each sampled operation by USDA NASS employees, trained and supervised by research team members.

If the agricultural operation met all eligibility criteria, the household was asked to participate in the study. Operations that did not meet the criteria were excluded from the study. Details of the subsequent telephone interviews in which participants would be involved, as well as rights regarding participation and informed consent, based on federal guidelines for protecting human subjects in research, were addressed in the initial mailing as well as during the screening interview.

Households that met eligibility criteria and agreed to participate were then mailed comprehensive packets of information regarding the study and the subsequent interviews to be conducted. These packets contained: (1) cover letters from the study investigators and the respective state NASS offices; and, (2) comprehensive booklets, including logs to maintain ongoing information pertinent to injury occurrences (according to the injury definition) between January 1st and June 30th, and telephone interview information for facilitating the interviews. Comparable mailings were implemented for the second six months of data collection (July 1st through December 31st, each study year).

Full-length telephone interviews with the eligible and participating agricultural households began in July of each study year, and January of the following year, to collect

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data for the respective prior six-month periods. A six-month period was chosen to maximize quality of reporting while minimizing cost of follow-up, based on past experience and validation studies (Gerberich et al., 1990; Braun et al., 1994). If it was not possible to conduct the interview at the time of first contact, an appointment was made to conduct the interview at a later time.

Households that refused to participate in the full interviews were asked to complete an abbreviated interview. This interview was designed to collect basic information on the members of the household, the size and nature of the agricultural operation, and on the occurrence of injuries during the identified study period.

Data Collection Instruments

Data collection instruments were designed in the form of a Computer Assisted Telephone Interview (CATI). Although the questions/content incorporated in the data collection instruments remained intact from the 1999 to 2001 efforts, select modifications were made to adapt the instruments to the relevant study periods and to enhance the quality of data collected. The study investigators worked directly with USDA CATI programmers to complete these changes and to test all data collection instrument components:

1) Screening Interview:

As detailed above, the first component consisted of a screening interview that provided information pertinent to provision of informed consent, facilitated determination of eligibility, and solicited participation. Eligible agricultural households that agreed to participate were then followed through the subsequent interviews

2) Full Interviews (Data Collection):

a) Household Log

Data collected on all members of the households included: date of birth, gender, education, race, number of hours worked per week in agriculture, lifetime occurrence of agricultural injury, and whether an injury was incurred during the study period as well as the relevant surrounding circumstances and consequences of any injury events.

b) Injury Log

For any identified injury event, data were collected on the nature of the injury, the

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source/vehicle of injury, relevant circumstances at the time of the event, and subsequent consequences. Extensive branching enabled comprehensive interviews pertinent to a variety of sources/vehicles of injury.

c) Exposure Log (Data Collection for Case-Control Study)

Cases were questioned about their exposures prior to the month of the injury incidents, while controls were questioned about their exposures during the month before a randomly selected month, to provide exposure information comparable to that for case children. Data collected for both cases and controls included *behavioral information*: for example, numbers of hours worked per day/week/month; desire to demonstrate compliance with assigned chores; ability to follow rules; levels of impulsivity, independence, distractibility, cautiousness, and irritability; and safety awareness. Data pertinent to *environmental exposures* included: acres in active production; types of agricultural operations; numbers of various types of animals present on the operation; numbers of various types of equipment in use; types of specific direct exposures (e.g., riding on/operating a tractor; working with a forage harvester, baler, or auger; working with beef cattle or dairy cattle, etc.); education/training in specific activities and/or use of equipment; hours worked on the agricultural operation and in other jobs; hours spent in school; parent/guardian injury experience and perception of risk, safety awareness, and level of supervision; and socioeconomic status of the household.

Proxy respondent data on childhood injury have been reported as both reliable and valid (Macarthur et al., 1997) and have been used in previous studies by the investigators. In the current study, the female head of household was the preferred key informant for the collection of demographic information on the members of the household as well as the identification of any injury events incurred by persons associated with the agricultural operations and respective households. For key information pertinent to their own exposures, the case or control children were preferred as respondents. Permission to interview persons 12 to <18 years of age was obtained from the parent at the time of the interview, as appropriate; those ≥18 years of age could respond for themselves, unless they preferred that one of their parents respond for them. For persons younger than 12, either the male or female head of household was the proxy respondent for exposure

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information, unless the parent requested that the interviewer speak directly with the child. The male head of household was the preferred key respondent for information on the characteristics of the agricultural operation and the general operation exposures (e.g., acres in operation, primary enterprise, direct exposures to animals and machinery).

Interviewer Training and Quality Control

The USDA NASS interviewers regularly conduct agricultural census surveys with farmers and ranchers. As a result, they were familiar with agricultural terminology and were highly experienced in interviewing operation owners and relevant household members. Training manuals, developed by the research team, were also used as a basis for interviewer training, as well as a reference guide for interviewers through the duration of data collection. Special interviewer training programs, conducted by project staff, focused on the nature and purpose of the project, the overall project protocol, issues related to the use of human subjects, and the specific use of the interview instruments. A particular emphasis was placed on the process used to identify subjects who were injured during the study period in order to obtain accurate information on these events. Interviewer training included classroom instruction, demonstration of the CATI instrument and system, and practice interviews using pre-established scripts; these scripts were designed to ensure that all aspects and possible branches of the instruments were recognized by, and familiar to, the interviewers. In addition to the comprehensive training, the interviewing process was also monitored by USDA NASS supervisory staff, in concert with the project investigators, in an ongoing manner.

Data Management

A project management information system was developed to monitor the status and progress toward the completion of the interviews and to ensure data integrity. A detailed protocol/manual of operations was developed for the 1999 Phase 1 effort, and was modified for use during the data collection phase of the 2001 effort. The manual served both as a reference manual and training guide for all data collection procedures and project policies as well as a source for understanding respondents' answers.

Data Processing

The majority of coding and data entry was incorporated into the interview process

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as part of the CATI instrument. This system also enabled immediate flagging of inappropriate or out-of-range responses so that clarifications could be made during the course of the interviews. Data were collected through specific branching in the CATI for relevant sources/vehicles of injury, and associated activities; in addition, relevant information was recorded in narrative form and later coded using the International Classification of Diseases–Ninth Revision, External Cause codes (ICD-9 E-codes) (French et al., 1989). A set of supplemental E-codes, developed for use in the 1990 RRIS–I (Gerberich et al., 1993), was also utilized (Carr et al., 1992) to provide additional specificity in coding agricultural injuries. ICD-9 diagnostic codes were not assigned to injury events as professional health care diagnoses were not systematically collected. However, a simplified coding structure, that was also used in the 1990 RRIS–I, was used to code the types of injuries (Gerberich et al., 1993; 2003; 2004).

Project management information for items such as the disposition and status of interviews was provided by the data management capabilities of the CATI system. Following initial cleaning and removal of personal identifiers, data files were transferred by USDA NASS programmers to the research team for data processing and analyses. Subsequently, extensive data checking and cleaning were completed prior to the initiation of any analyses by research staff. Project staff members were responsible for ongoing management of the data files and for developing comprehensive computer programs for conducting analyses of the respective project components.

Data Analyses

Preliminary data analyses were completed on each individual data set (1999 and 2001); these included basic descriptive statistics on the sample and the incidence and consequences of reported events (Gerberich et al., 2003; 2004). Analyses addressed occurrences of: (1) agricultural injuries on the participants' own operations, or on (2) another operation, and (3) injuries related to all other types of activities. Rates of injured persons per 1,000 persons at risk, injury events per 1,000 persons at risk, and injured persons and events per 100,000 hours of agricultural work time, were generated. Annualized injury event rates, adjusting for months absent from the operation, were also calculated. Rates were adjusted for within-household correlation using generalized

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estimating equations (GEEs) (Liang and Zeger, 1986), excluding levels for missing values and non-response. Potential selection bias was addressed by inversely weighting observed responses with stratum-specific probabilities of response (Horvitz and Thompson, 1952), estimated as a function of characteristics available from the NASS database (state in which the operation was located; type of operation; annual revenue by quintile). To account for unknown eligibility among non-respondents, probability of eligibility was estimated for these same characteristics and used to adjust weights (Mongin, 2001). Confidence intervals for injury rate estimates were computed using SAS proc *genmod* (SAS, 2000).

In addition, the impact of various exposures of interest on the risk of children's agricultural injury, controlling for potential confounding factors, was also examined (Gerberich et al., 2003; 2004). Risk factors of primary interest included direct exposures, such as: riding on/operating a tractor, working with/operating a forage harvester, baler, or auger, or working with beef or dairy cattle, or swine. Other demographic factors, such as age, gender, race/ethnicity, socioeconomic status, and history of previous agricultural injuries, were also examined.

Results of the analyses of the 2001 Phase 2 data were compared to those from the 1999 Phase 1 study, in order to identify any relevant changes (Gerberich et al., 2004). Based on strong similarities, in terms of demographics, injury experience, and pertinent exposures, the two databases were combined for the current study. To test validity of using the combined data, select multivariable logistic regression models were fit to each individual data set (1999 and 2001) in separate analyses. Results of these validation efforts are presented in **Table 1**.

Current Analyses

Aim 1

Behavioral traits as risk/protective factors for children's agricultural injury (Chapter 4)

In recent years, the study of behavioral risk factors has subsided in favor of a more resolute focus on environmental hazards and passive interventions. However, given that this approach has had limited success in the agricultural community (DeRoo and

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Rautiainen, 2000; Lee et al., 2004), a multifaceted approach to prevention of children's agricultural injury is warranted. Improved knowledge of the role of children's behaviors on their risk of agricultural injury could enhance current and future intervention efforts. The purpose of this analysis was to analyze associations between reported behavioral traits among children and their risk of agricultural injury on family farming and ranching operations.

In the RRIS–II nested case-control study, responses were elicited for 18 behavioral items adapted from commonly used inventories; most were from the Parent Observation of Child Adaptation (POCA) checklist (Ialongo et al., 1999). These items were assessed only among children ages five through <20 years. However, due to an error in the CATI program, responses were missing for 73 of the 75 (97%) children five years of age. The analyses described herein were thus restricted to children between six and <20 years.

Behavior-related questionnaire items included: "Would you say that [child's name] almost never, sometimes, often, or almost always..." ...completed work/chores; followed rules; worked hard; planned carefully before going ahead; was cautious; paid attention; had good concentration. Based on the literature relevant to children's behavior and injury risk, it was hypothesized that these positively perceived behavioral traits would be associated with a decreased risk of agricultural injury. Behavioral items expected to be associated with an *increased* risk of injury included: "Would you say that he/she [child's name] almost never, sometimes, often, or almost always..." ...acted without thinking; got into fights; was impulsive; broke rules; couldn't sit still; was easily distracted; was irritable; left the house or farm without permission; looked sad or down; bullied or was mean to others; had low energy.

Behavioral items were in ordinal format, with the categories of "almost never," "sometimes," "often," and "almost always" as potential responses. Individual behavioral items were dichotomized to allow comparisons of children who almost always or often exhibited the behavior (almost always/often), versus those who almost never or sometimes did (almost never/sometimes).

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Multivariable analyses were used to examine the associations between each behavioral item, identified above, and children's risk of agricultural injury while controlling for children's gender and age, variables highly pertinent to adolescent development and behavior. Multivariable analyses were also used to estimate the risk of agricultural injury for children with each behavioral trait, while controlling for gender, age, and additional potentially confounding variables; the remaining 17 behavioral items were also included in these models to reduce the risk of co-confounding. Logistic regression was used to identify odds ratios and 95% confidence intervals for each association of interest (Breslow and Day, 1987). Based on an overall conceptual model (**Figure 1**), and the causal model derived from it (**Figure 2**), directed acyclic graphs (DAGs) guided specification of the multivariable logistic regression models for each analysis.

The DAGs, based on published information, deduction from this information, and previous knowledge of injury mechanisms, enabled the most appropriate specification of variables for inclusion in the full multivariable models; these methods are discussed by Greenland et al. (1999) and illustrated by Hernán et al. (2002). As an example, to examine the association between children's levels of cautiousness and their risk of agricultural injury, model covariates would include gender, age, body mass index, number of hours worked on the operation, parents' average age, parents' highest education level, number of children in the household, operation state, operation type, and operation income. Descriptions of each variable in the Causal Model, and justification for the hypothesized relations between them, are presented in **Table 2**.

Because RRIS–II data are correlated by household (i.e., cases and controls from the same households are similar to each other in terms of exposure and injury distributions), the sample independence assumption underlying logistic regression is violated. To adjust for these hierarchical data, statements specifying the correlation of within-household measures were incorporated into the regression models using generalized estimating equations (GEEs) (Liang and Zeger, 1986). Also, as described previously, potential selection bias was addressed by inversely weighting observed responses with stratum-specific probabilities of response (Horvitz and Thompson, 1952),

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estimated as a function of characteristics available from the NASS database (state in which the operation was located; type of operation; annual revenue by quintile). To account for unknown eligibility among non-respondents, probability of eligibility was estimated for these same characteristics and used to adjust the weights (Mongin, 2001)

Behavioral Scales

The 18 behavioral items were also used to develop scales relevant to the agricultural population; hypothesized *a priori* constructs, based on POCA scales from which items were selected, were modified based on results of exploratory factor analysis (EFA). Factor analysis is a statistical method used to explain the most covariance in a set of related variables with a small number of explanatory constructs (i.e., latent variables, or, factors) (Field, 2000). For the current study, factor analysis was used to infer a subset of meaningful behavioral scales from the original 18 items for the purpose of modeling injury risk in the population of interest. For example, based on results of EFA, six items originally expected to factor together were hypothesized to instead represent two distinct constructs for children on agricultural operations. These were: child was easily distracted; paid attention; had good concentration; worked hard ("Self-regulation") and, child completed work; followed rules ("Responsible Conduct").

For the current EFA, maximum likelihood analyses with promax oblique rotations were performed using SPSS version 12.0 for Windows (SPSS, 2003). Normality of distributions was verified and items with kurtosis greater than 7.0 or skewness greater than 2.0 were excluded. Through an iterative process, factors with eigenvalues greater than 1.0 and items with absolute values greater than 0.40 for factor loadings were retained for subsequent analyses until a set of interpretable constructs was reached (Floyd and Wideman, 1995). Cronbach's alphas were used as a test of internal consistency for resulting scales (Cronbach, 1951).

Five scales were developed using this combined approach: (1) Depression: Child looked sad or down; had low energy; was irritable (Cronbach's alpha = 0.58); (2) Aggression: Child broke rules; got into fights; was impulsive (alpha = 0.51); (3) Self-Regulation: Child was easily distracted; paid attention; had good concentration; worked

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hard (alpha = 0.78); (4) Careful/Cautious: Child was careful; was cautious (alpha = 0.58); and (5) Responsible Conduct: Child completed work; followed rules (alpha = 0.60).

Item responses were reversed, where appropriate, for the five scalar constructs. Distributions were skewed and, thus, scores were categorized to compare children with the least desirable level of the behavior (to the extent possible, those within the 10^{th} percentile tail) to those with more moderate (10^{th} to $<50^{th}$ percentile) and desirable (50^{th} to 100^{th} percentile) levels. Depending on the direction of the scale, these categories were referenced as "high," "medium," and "low."

Aim 2

Children's behavioral traits as determinants of environmental exposures (Chapter 5)

Improved understanding of the behavioral determinants of children's high-risk environmental exposures could help focus intervention efforts targeted at preventing childhood agricultural injury. The purpose of this analysis was to identify associations between children's behavioral traits and their high-risk environmental exposures. It was hypothesized that behavioral characteristics such as "distractibility" and "impulsivity" would be negatively associated with children's exposures to high-risk environments due to protective measures taken by parents. Alternatively, it was expected that traits such as "cautiousness" would exhibit a positive association with high-risk exposures, as cautious children may have been assigned higher-risk responsibilities by their parents.

To test these hypotheses, analyses were performed to examine the associations between behavioral items and scales and high-risk environmental exposures. Negatively perceived behavioral traits examined included: acted without thinking; got into fights; was impulsive; broke rules; couldn't sit still; was easily distracted; was irritable; left the house or farm without permission; looked sad or down; bullied or was mean to others; and, had low energy. Positive traits included: completed work/chores; followed rules; worked hard; planned carefully before going ahead; was cautious; paid attention; and, had good concentration. Behavioral scales were based on hypothesized *a priori* constructs and exploratory factor analyses, as described above; these included: depression, aggression, self-regulation, careful/cautious, and responsible conduct.

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Based on results of the initial risk factor research (Gerberich et al., 2003; 2004), environmental exposures defined as "high-risk" included: work with horses, beef cattle, or sheep; driving or riding as a passenger in motor vehicles; operating tractors with greater than 20 horse-power; or bystanding any of the above activities. Each of these exposures was identified as an injury risk factor for both the 1999 and 2001 cohorts. Other environmental risk factors examined included: work with dairy cattle, swine, or poultry; riding on tractors; and working with large machinery or small equipment.

Questions ascertaining exposure to high-risk work environments were posed in nominal (yes/no) format; hours of exposure to each specific environment were then asked of those with a positive response. Multivariable analyses were utilized to estimate exposure to high-risk environment, for those with behavioral traits of interest, while controlling for gender and age. A further multivariable model adjusted for gender and age, in addition to other potentially confounding variables, as well as remaining behavioral items and scales, respectively.

Odds ratios and 95% confidence intervals were estimated using multivariable logistic regression (Breslow and Day, 1987). The causal model (**Figure 2**) was again used as a basis for specification of directed acyclic graphs (DAGs) for each association of interest, which informed selection of the potential confounders for the full multivariable model. Resulting models included: children's gender, age, body mass index, and number of hours worked on operation; parents' average age, highest education level, and number of children in household; and operation state, operation type, and level of income. Behavioral item responses were dichotomized, and combined for use as scales, as described for Aim 1 above. The nominal format for the dependent variables (high-risk environmental exposures) was used. Estimates were also adjusted for within-household correlation, probability of eligibility, and probability of response.

Aim 3

Intra-familial risk of injury driven by shared high-risk behavioral traits and/or high-risk environmental exposure (Chapter 6)

Based on various learning theories, as applied to parenting, a negative association between parents' past agricultural injuries and children's risk of injury would be

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expected. However, findings to the contrary (Carlson et al., 2006) indicated that risk of agricultural injury is correlated within families and may not be mediated as expected if a parent incurs an injury. The purpose of Aim 3 was to examine the hypothesis that this intra-familial risk is due to common exposures, behavioral and/or environmental, among family members on agricultural operations.

Multivariable analyses were first performed to verify the association between parents' past agricultural injuries and children's risk of injury in the combined Phase 1 and Phase 2 data set (results identified in **Table 1**). Potential confounders included in these models were: parents' age, gender, and education; number of children in the household; and operation type, state, income; and total family hours worked per week. For parent-related covariates, data specific to fathers or mothers were used for the respective analyses of fathers' and mothers' injuries. For analyses of combined parental injury history, mothers' data were included assuming these factors have a greater effect on children's risk.

Subsequent to verifying associations between parents' and children's injuries in the combined data set, high-risk behavioral traits and high-risk environmental exposures were tested as causal mediators in the association between parents' and children's injuries. Based on the overall conceptual framework identified in Figure 1, **Figure 3** represents the causal model used to address this hypothesis. With the dotted lines representing the associations that were tested, this model identifies alternative pathways between parents' and children's injuries, through behaviors and environmental exposures, which may explain the previously observed associations. In this model, parents' behavioral traits (at "time 0" or t_0) are purported to affect their risk of agricultural injuries that, in turn, affect their future behavioral traits (at t_1) and risk of injury. Parents' behavioral traits, at "time two," are also likely to influence their children's behavioral traits, as well as their environmental exposures, which could explain the previously observed increased risks of injury among children whose parents had incurred prior injuries.

This alternative potential pathway will be tested by analyzing the association between parents' and children's injuries while statistically controlling for children's

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behavioral traits and environmental exposures. For parents' *recent* agricultural injuries, controlling for these factors will block a potential backdoor pathway through parents' t_1 behavioral traits, while, for parents' *prior* injuries, controlling for these factors will provide an estimate of any direct causal effect parents' injuries may have on children's risk, while holding behaviors and exposures constant. If no associations between parents' and children's agricultural injuries are observed while controlling for these variables, it could then be argued that this causal model better explains the observed intra-familial associations in risk.

For these current analyses, covariates representing high-risk environmental exposures were based on findings from preliminary analyses of the Phase 1 and Phase 2 data. These were used independently and also combined to form a composite score representing overall hazardous exposures to children. High-risk behaviors were based on results of the analyses for Aim 1 and were also included in the models as behavioral constructs.

Sample Size Considerations

The potential risk factors considered of primary interest for this study included: children's behavioral traits, children's high-risk environmental exposures, and parents' agricultural injury history. For purposes of this estimation, the prevalence levels of distractibility (often/almost always), impulsivity (often/almost always), and cautiousness (sometimes/almost never) were used to represent behavioral factors of interest. Exposure to tractors, large machinery, and cattle (yes/no) were used to represent high-risk environmental exposures. Further, the prevalence of both parents having sustained injuries prior to the respective study year (1999 or 2001) was used to represent parents' agricultural injury history.

Based on the combined ascertainment of 379 case events and 1,562 controls, ages six to <20 years, over 1999 and 2001, equation 6.11 in Schlesselman (1982) was used to calculate the minimum detectable risks of agricultural injury for these exposures of interest, as a function of the following parameters: (1) alpha = 0.05 (two-sided); (2) power = 0.80; (3) case number of 379; and (4) 4.1 controls per case. The prevalence of

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each exposure was calculated using the pooled RRIS–II data (1999 and 2001) for children between six and <20 years of age in the control population.

As shown in **Table 3**, the minimum detectable relative risks ranged between 1.3 and 1.5 for the selected variables. Broken down by gender (not shown), the minimum detectable risks for males ranged from 1.4 to 1.6 and, for females, between 1.5 and 1.9. Given these estimates, the minimum detectable risks for the associations of interest were reasonable for the total population as well as for each gender.

Bias Evaluation

These analyses were based on data from Phase I and Phase II of the Regional Rural Injury Study – II (RRIS–II). Multiple measures, described below, were taken during the design and implementation of these studies to minimize issues of bias. Further actions were taken to control bias, and quantify any remaining potential bias, through analyses.

Information Bias

An important consideration in any epidemiologic effort is the assessment of measurement error. Measurement error is thought by methodologists to be one of the most serious threats to the validity of epidemiologic study results because it can result in a large amount of bias (Maldonado, 1993; Greenland, 1990; Copeland et al., 1977; Dosemeci et al., 1990; Gilbert, 1991; Flegal et al., 1991; Wacholder et al., 1991). It is anticipated that there was a potential for measurement error in the reporting of both injury events and behavioral and environmental exposures pertinent to these events; this problem was addressed in several ways. First, potential errors in reporting injury and relevant exposures were minimized through use of a six-month recall period (Gerberich et al., 1990; Braun et al., 1994), careful development, modification, and testing of the CATI instrument, and comprehensive interviewer training. Second, a validation sub-study (described below) was conducted to help estimate the degree of measurement error due to self-reporting of physical injuries and their consequences. In addition, a reliability sub-study was conducted to determine the degree of reproducibility in responses (Kelsey et al., 1996).

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Validation sub-study procedures were conducted for self-reported injury occurrences through review of health care records (Gerberich et al., 2003; 2004). The medical validation of reported injuries is important to evaluate the error in injury self-reporting, so that the extent of bias due to this error can be assessed. Although there was no comprehensive database with medical care records available for the total population, the following procedure was employed to facilitate assessment of both sensitivity and specificity: all injured participants (cases), and an equal number of controls, were selected and mailed letters explaining the sub-study including informed consent information. Consent forms, enabling release of the injury information to the study staff, and stamped, pre-addressed return envelopes were also enclosed. Participants provided names and contact information for any health care providers that they may have seen during the study period. Upon receipt of the signed consent form, each health care source was sent a letter along with a copy of the consent form, and a one-page questionnaire asking about any health care contacts by the person for injuries during a specified period that spanned at least six months on either side of the reported/potential event. Data from the validation sub-study were used to help identify false negatives and false positives in the reporting of injury events.

For 1999, the total response providing consent for access to health care records was 8.5% (n=35) while, in 2001, total response was 5.8% (n=26). Among the 35 responses in 1999, names and contact information for 44 health care providers were included. Of these, 41 (93.2%) providers returned the study form, indicating whether or not the patient had incurred an injury during the specified time period. Overall results for 1999 were: Sensitivity = 0.708; Specificity = 0.423; Positive Predictive Value = 0.531; and Negative Predictive Value = 0.611.

Among the 26 responses, for 2001, that provided consent for access to injury-specific health care records, names and contact information for 44 health care providers were included. Each of the providers contacted (100%) returned the study form, indicating whether or not an injury occurred during the specified time period. Overall results for 2001 data were: Sensitivity = 0.818; Specificity = 0.790; Positive Predictive Value = 0.692; and Negative Predictive Value = 0.882.

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These summary statistics show potentially disconcerting amounts of measurement error for injury outcomes, especially for the 1999 study phase. However, given that the response rates for the validity studies were exceptionally low for both years, it is difficult to draw any valid conclusions from the results of this sub-study. The results of the 1987-1988 Olmsted Agricultural Trauma Study (OATS) validation study, which showed optimum recall of injury events within a six-month reporting period (Gerberich et al., 1990), would indicate reasonable levels of measurement error in the current study, given the similar six-month reporting windows.

A sub-study was also used to evaluate the reliability of the information provided by the respondents (Gerberich et al., 2003; 2004). For the 2001 Phase 2 study, a systematic random sample of 300 respondents was selected, and reliability assessment interviews, encompassing representative questions from all sections of the original data collection instruments, were administered from one to two months after the original interview. To avoid burdening the respondents with having to answer all reliability-related questions, three separate reliability questionnaires were used and randomly assigned to the selected respondents. Of the potential 100 respondent households for each questionnaire, 94 Household and 98 Injury questionnaires were completed and had usable data, which also resulted in 192 respondent households for the overlapping injury questions. In addition, 78 Exposure questionnaires were completed and had usable data. Based on results of the reliability sub-study interviews, it was determined that 11 exposure questionnaire (case-control) subjects were not in residence during the index month and were, thus, not included in the analyses.

Reliability assessment is based on matching responses from the same participants on at least two separate test-retest occasions, during a short time frame. Retesting is believed to be most efficacious within 14 to 28 days of administration of the original interview, depending upon the nature of the information being collected (Wennberg and Bohman, 1998; Booth et al., 1996). In this study, reliability surveys were administered at least six months after the full-length interviews. This would be expected to substantially decrease reporting reliability; however, this time delay was necessary to decrease the overall survey burden on both the interviewees and the interviewers. Given this

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limitation, the available evidence suggests adequate reliability of the RRIS–II data. On key survey items, percent concordance ranged from 57.6% to 98.8%, with associated kappa coefficients of 0.371 to 0.975. Most importantly, items pertinent to the calculation of injury rates, such as basic demographics, injury incidence, and most exposures, had adequate concordance.

Selection Bias

The efficiency of the case-control design results from studying only a sample of the cohort at risk (Greenland, 1994). With the increased efficiency, however, comes the potential for selection bias due to the way in which subjects are sampled into the study. Selection bias can occur if: (1) the cases in the study are a biased sample of the cases in the study population during the study period; or (2) the controls in the study are a biased sample of the population at risk during the study period. Since biased samples of cases and controls can occur for many different reasons, case-control designs should incorporate evaluation of the potential impact of selection bias on effect estimates.

Potential selection bias in the current studies was addressed by inversely weighting observed responses with probabilities of response (Horvitz and Thompson, 1952), estimated as a function of the following characteristics available from the NASS Master List Frame: state in which the operation was located; type of operation; and operation revenue, by quintile. To account for unknown eligibility among non-respondents, probability of eligibility was estimated for these same characteristics (Mongin, 2001). Further, agricultural households that refused to participate in the full interview, or who were not successfully contacted after an exhaustive contact protocol was completed, were mailed a cover letter, brief survey, and a postage-paid, return envelope in order to obtain information relevant to eligibility. This abbreviated survey requested information on the size of the household, size and nature of the agricultural operation, and the occurrence of injuries during the study period. As with bias due to measurement error, it was not possible to fully correct effect estimates for selection bias. However, potential effects of both measurement and selection biases on study results were assessed using probabilistic uncertainty analyses (Maldonado, 2006).

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Uncertainty Analyses

Probabilistic uncertainty analyses were conducted to assess the likely magnitude and direction of study bias due to the above potential errors, in addition to further error factors inherent in observational studies. Using methods similar to those of Vose (2000) and described by Maldonado (unpublished manuscript, 2006), the robustness of each model was assessed while simultaneously accounting for potential biases due to confounding, measurement error, selection bias, and specification bias.

As described by Maldonado, the observed odds ratios, E(RR), presented in this study are the products of true odds ratios, RR_{causal} (i.e., effects of behavioral traits on children's risk of agricultural injury), all error factors, and random error, such that:

$$E(RR) = RR_{causal} \bullet \frac{\alpha_{1i}\,\delta_{0i}}{\beta_{1i}\,\gamma_{0i}} \bullet \frac{\alpha_{1j}\,\delta_{0j}}{\beta_{1j}\,\gamma_{0j}} \bullet E, \text{ for } i \neq j$$

Each error factor represents a calculation of the differential associations between the sources of bias and exposure or outcome misclassification; two theoretical error factors are identified in the above equation. Simple algebra allows the calculation of the true causal effect of the exposures of interest (i.e., children's behavioral traits) on the outcome (i.e., children's agricultural injuries), under the condition of specified values for all error factors:

$$RR_{causal} \bullet E = \frac{E(RR)}{\frac{\alpha_{1i}\,\delta_{0i}}{\beta_{1i}\,\gamma_{0i}} \bullet \frac{\alpha_{1j}\,\delta_{0j}}{\beta_{1j}\,\gamma_{0j}}} \text{ for } i \neq j$$

Assuming no other issues of validity, then, the estimated odds ratios from each study are the products of true odds ratios and *all* error factors (confounding, measurement error, selection bias, specification bias, and random error):

$$RR_{causal} = E(RR) / (E_{confounding} \bullet E_{measurement} \bullet E_{selection} \bullet E_{specification} \bullet E_{random})$$

For the current study, Monte Carlo simulations were performed in order to forecast the product of the error factors and, then, the potential distributions of true odds ratios for each independent variable. Crystal Ball Risk Analysis Software was used for these analyses (Decisioneering, 1998). Since the magnitude and distribution of each error factor ("priors") must be specified, yet are unknown, analyses were run using three

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different scenarios for comparison: (1) under the assumption that the product of all study errors equals one (the default value when uncertainty analyses are not performed); (2) under the assumption that *limited* data pertinent to validity (i.e., from validity sub-studies) are available for extrapolation to uncertainty analyses – hence, possible distributions for each prior are relatively wide; and, (3) under the assumption that *comprehensive* data pertinent to validity are available for extrapolation, resulting in the use of narrower distributions, or less differential response patterns, between exposed and non-exposed participants.

Compared to the first scenario, the second and third require much more in-depth thought and explicit descriptions pertaining to the possible values for each prior. As an example, for analyses relevant to Aim 1, the effects of confounding, measurement error, and selection bias on the differential recording of children's behavioral traits and injuries, and the effects of specification bias, in addition to random error, on calculated associations between behaviors and injury, must be defined.

For confounding, it was assumed that the control children were an imperfect substitute for what *would have* happened with the case children, had they had alternative behavior profiles. Given that the statistical adjustments for confounding were unlikely to control all demographic and/or exposure differences between the case and control children, values for residual confounding were centered at one (which would assume no confounding), but allowed to vary by ten percent (Scenario 2), or one percent (Scenario 3), assuming uniform distributions.

Despite the careful methodology, as described above, recall bias was assumed to be the most important source of measurement error in this study, give the self-reported nature of exposure and outcome data. For purposes of the uncertainty analyses, it was hypothesized that families with children who had been injured would be more likely to report undesirable behaviors than families with children who had not sustained injuries. Thus, values for correct recall were estimated using (100 – frequency) of each high-risk behavior as the baseline mean value, and allowing these values to vary for each cell in the respective 2x2 tables. Normal distributions with standard deviations of 10% (Scenario 2) or 1% (Scenario 3) of each value were also assumed. For the behavioral construct of

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"self-regulation," frequency of response for the lowest category in this population was 10.4 percent. With (100 – 10%) 90% as the baseline value, estimated mean values for correct recall were: exposed cases = 92%; unexposed cases = 84%; exposed controls = 94%; and unexposed controls = 90%.

To account for all potential sources of selection error, effects of sampling bias, losses to follow-up, case and control non-response, and missing data were each considered. Sampling bias, which is generated when those identified as eligible are non-randomly sampled, was addressed by assuming normal distributions of bias for each cell in the 2x2 tables, and centering these distributions at one (which would assume no sampling error). Standard deviations were again set at 0.1 (Scenario 2) and 0.01 (Scenario 3). Data on eligible households who declined to participate were used to consider the effects of losses to follow-up. In general, it was assumed that those who were lost to attrition were more likely to: (1) have undesirable behavioral traits, and (2) have been injured. This is based on an assumption that non-respondents were more sensitized to behavioral or child labor issues, or, that these families were too busy to participate, likely indicating more exposure to hazards (and thus more frequent injuries) to children. Given that 15.8% of households identified as eligible chose not to participate in the study, average response proportions for each cell in the 2x2 tables was set to equal 84.2%. The distributions were assumed to be normal, and were truncated at 0 and one to reflect the fact that they represented response proportions. Mean values were: exposed cases = 76.2%; unexposed cases = 88.2%; exposed controls = 80.2%; unexposed controls = 92.2%. Standard deviations were set at 10% (Scenario 2) and 1% (Scenario 3) of each mean value.

Similar criteria were used to address case and control non-response, as well as missing data. Of the eligible cases and controls that were asked to participate, 91% and 97% participated in the case-control study. Assuming that those who did not participate were more likely to be exposed and/or injured, mean values for response proportions were set at: exposed cases = 86%; unexposed cases = 96%; exposed controls = 95%; unexposed controls = 99%. Standard deviations were again set at 10% (Scenario 2) and 1% (Scenario 3) of each value. For observations with missing data, it was assumed that

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these participants were more likely to have been exposed than not, with this tendency being stronger for cases than for controls. For "self-regulation," exposure status was unknown for seven cases and 35 controls. Thus, the range of possible cases that were exposed was 0 – 7, while the range of possible controls that were exposed was 0 – 35. Assuming triangular distributions, the likeliest values for cases and controls were 6 and 21 (Scenario 2) and 4 and 17.5 (Scenario 3).

Similar to error factors for confounding, values for specification bias, which stems from model dependence on incorrect statistical assumptions, were assumed to vary across each cell in the 2x2 tables. Thus, assigning normal distributions, mean values were set at one (which would assume no bias) but with standard deviations of 0.1 (Scenario 2) and 0.01 (Scenario 3).

Comprehensive results of uncertainty analyses, and the priors specified for each, are presented in Chapter 7 for a sample of the major study findings. While it is not technically possible to "correct" risk estimates for bias due to study errors, uncertainty analyses can serve as an estimation of the effects of simultaneous error factors in the sense that upper and lower bounds for risk estimates may be analyzed (Maldonado, unpublished manuscript, 2006; Rothman and Greenland, 1998). Further, these methods serve as an improvement to the major assumption made (i.e., Scenario 1: which assumes that the product of all error factors equals one) when results are presented without quantitatively accounting for error sources inherent in observational studies.

It should be noted that the effects of random error were not considered in these uncertainty analyses, as calculations of random error effects are dependent upon assumptions that are known to be violated in observational studies. For example, it is clear that exposure distributions are not randomly allocated across study populations and that calculated point estimates are likely to be erroneous due to study imperfections. As a general precaution, then, it should be stated that the ranges of potential values for RR_{causal}, that were generated by these uncertainty analyses, would be wider had it been unproblematic to take random error into account.

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Summary

The current effort builds on prior findings from Phase 1 of the RRIS–II (Gerberich et al., 2003; Carlson et al., 2006). The highly knowledgeable research team for Phases 1 and 2 of the RRIS–II included members who had been involved in major relevant population-based studies of agricultural injury, including the Olmsted Agricultural Trauma Study (OATS) (Gerberich et al., 1991), the Regional Rural Injury Study – I (RRIS–I) (Gerberich et al., 1993), and the RRIS–II (Gerberich et al., 2003; 2004). Results of the current study addressed a deficiency in knowledge about the interplay of children's behaviors and exposures to hazardous environments, and the potential role in observed intra-familial risk of injury. Results of this project may contribute to the knowledge essential for development of appropriate efforts for prevention and control of children's agricultural injury.

Advantages and Limitations

This project was a collaborative effort among numerous entities, including the University of Minnesota, St. Mary's Duluth Clinic Health System, and the United States Department of Agriculture (USDA), in concert with representatives from participating states. Investigators and project staff within the University of Minnesota, School of Public Health, Division of Environmental Health Sciences and St. Mary's Duluth Clinic Health System, provided critical on-going professional and technical input to the project and were also responsible for the overall project management including coordination of all project tasks and monitoring of all data collection, processing, and analysis activities.

While these efforts addressed a deficiency in current knowledge about children's behavioral traits, environmental exposures, and intra-familial agricultural injury, findings must be interpreted in light of the study limitations. For example, as briefly described above, analyses may have been susceptible to recall bias, given the retrospective collection of behavior and injury data. However, while this potential for bias is of concern, multiple measures were taken to address this problem as well as other potential measurement and selection issues. Most importantly, based on prior validation efforts (Gerberich et al., 1990; Braun et al., 1994), injury data were collected for six-month windows to limit information bias. Additionally, behavior-related items were measured in

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reference to the months prior to the month of the injury events for cases, or before a randomly selected month for controls. Limited data, pertinent to agricultural operation state, size, and annual revenue by quintile, were also used in aggregate form to identify and adjust for differences in eligibility and response among households.

Given that a main intent of the RRIS–II was to serve as a tool for surveillance of the total burden of injury among all ages, and environmental risk factors for agricultural injury occurrence among children <20 years of age, the behavioral items measured were limited in scope and number. However, the 18 items used were selected based on their deemed importance to children's work and safety on agricultural operations. The hypothesized *a priori* constructs for behavioral scales were based mostly on the questionnaires from which the items were adapted; exploratory factor analyses were used to inform and improve these constructs for use in this specific population. Apart from the construct of self-regulation, Cronbach's alphas for each scale were relatively low. These may have resulted in part from the limited number of items included in each scale, as this measure is sensitive to item number (Cronbach, 1951), but may also indicate limited interpretability for the factors used. Nonetheless, this was a unique and important effort to evaluate behavioral scales in a population of farm and ranch family children.

Human Subjects

Phase 1 and Phase 2 of the Regional Rural Injury Study – II, which served as the basis for the current study, were approved by the University of Minnesota Institutional Review Board, Human Subjects Committee (IRB reference numbers 9706S00138 and 9201S04814). The protocol for the secondary data analyses in the current study was also approved by the University of Minnesota IRB (0506E71006) and was exempt from federal human subject regulations under the Exemption 4 category (review of existing data without personal identifiers) of 45 CFR Part 46. Background on protection of human subjects for the original data collection is provided below:

The risks associated with participation in the original projects (Phases 1 and 2 of the RRIS–II) were minimal. There were no physical risks associated with the study. While the risk existed for psychological stress associated with recalling circumstances surrounding a serious injury, multiple precautions were taken to minimize this risk.

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Specifically, participants were informed that they did not have to respond to questions that they found disturbing, and interviewers were specially trained to handle interviews in which there was an emotional response to injury-related questions.

Further, comprehensive information about the study was provided to participants prior to initiation of the study. Verbal consent to proceed with the telephone interview portions of the project, including the full interviews, was obtained during the initial telephone contact with operation households. Only those persons who agreed to participate at that time were included in the project. For the subset of the study population, included in the validation component of the project, written consent was sought for permission to review medical records pertaining only to injury. There was no further telephone contact with persons who refused to participate.

Confidentiality of personal data was protected through multiple measures: all telephone interviewers signed confidentiality statements acknowledging the private nature of the data collection process; all written project materials were maintained in locked filing cabinets; access to all computerized data files was protected through the use of passwords that restricted access to the files; and, written reports and manuscripts contained data in aggregate from only; no individual agricultural operations or participants were ever identified. Most importantly, personal identifiers were removed from the final data sets by USDA personnel prior to dissemination to the investigators.

As identified, risks to project participants were minimal due to the nature of participant involvement and the confidentiality procedures that were undertaken. As a potential benefit to those contacted, all households were advised that they had at least a 1 in 16 opportunity of obtaining a $100 United States Treasury Bond whether or not they participated fully in the study; incorporation of this incentive was based on past research efforts (Woodward et al., 1985; Elkington, 1990; Boyle, 1995; Gabel, 2000).

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REFERENCES

Bancej C, Arbuckle T: Injuries in Ontario farm children: a population based study. *Injury Prevention*, 6(2): 135-140, 2000.

Booth ML, Owen N, Bauman AE, Gore CJ: Retest reliability of recall measures of leisure-time physical activity in Australian adults. *International Journal of Epidemiology*, 25(1): 153-159, 1996.

Boyle D, Gerberich SG, Gibson RW, Maldonado G, Robinson A, Martin F, Renier, CM: Case-control study of dairy-operation related injuries: Rate ratios associated with dairy activities. *Epidemiology*, 8: 37-41, 1997.

Braun BL, Gerberich SG, Sidney S: Injury events: Utility of self-report in retrospective identification in the USA. *Journal of Epidemiology and Community Health,* 48(6): 604-605, 1994.

Breslow NE, Day NE: *Statistical Methods in Cancer Research. Volume II - The Design and Analysis of Cohort Studies.* Lyon, France: International Agency for Research on Cancer Scientific Publication, 82:1-406, 1987.

Brison RJ, Pickett W, Berg RL, Linneman J, Zentner J, Marlenga B: Fatal agricultural injuries in preschool children: risks, injury patterns and strategies for prevention. *Canadian Medical Association Journal*, 174(12): 1731, 2006.

Boyle D, Gerberich SG, Gibson RW, Maldonado G, Robinson A, Martin F, and Renier, CM: Case-control study of dairy-operation related injuries: Rate ratios associated with dairy activities. *Epidemiology*, 8: 37-41, 1997.

Boyle D: *Case-Control Study of Dairy Cattle Operation Injuries*. Doctoral Dissertation, Minneapolis, Minnesota: University of Minnesota, 1995.

Carlson KF, Langner DM, Alexander BH, Gurney J, Gerberich SG, Ryan AD, Renier CM, Mongin SJ: The association between parent and child agricultural injuries in the Regional Rural Injury Study – II. *Archives of Pediatrics and Adolescent Medicine*; In Press, 2006.

Carr P, French LR, Gerberich SG, Gibson RW, Gunderson PD, Renier CM: Supplemental ICD-9-CM external cause codes for agricultural injuries. *Third*

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

International Symposium: Issues in Health, Safety and Agriculture, Saskatoon, Saskatchewan, May 1992.

Caspi A, Harrington H, Moffitt TE, Begg D, Dickson N, Langley J, Silva PA: Personality differences predict health-risk behaviors in young adulthood: Evidence from a longitudinal study. *Journal of Personality and Social Psychology*, 73(5): 1052-1063, 1997.

Celis A, Gomez Z, Martinez-Sotomayor A, Arcila L, Villasenor M: Family characteristics and pedestrian injury risk in Mexican children. *Injury Prevention*, 9(1): 58-61, 2003.

Chen E, Martin AD, Matthews KA: Socioeconomic status and health: do gradients differ within childhood and adolescence? *Social Science and Medicine*, 62(9): 2161-2170, 2005.

Cogbill TH, Steenlage ES, Landercasper J, Strutt PJ: Death and disability from agricultural injuries in Wisconsin: a 12-year experience with 739 patients. *Journal of Trauma*, 31(12): 1632-1637, 1991.

Copeland KT, Checkoway H, McMichael AJ, Holbrook RH: Bias due to misclassification in the estimation of relative risk. *American Journal of Epidemiology*, 5: 488-495, 1977.

Cronbach LJ: Coefficient alpha and the internal structure of tests. *Psychometrika*, 16: 297-334, 1951.

Cubbin C, LeClere FB, Smith GS: Socioeconomic status and the occurrence of fatal and nonfatal injury in the United States. *American Journal of Public Health*, 90(1): 70-77, 2000.

Davidson LL: Hyperactivity, antisocial behavior, and childhood injury: A critical analysis of the literature. *Developmental and Behavioral pediatrics*, 8(6): 335-340, 1987.

Davidson LL: Hyperactivity in school-age boys and subsequent risk of injury. *Pediatrics*, 90(5): 697-702, 1992.

Decisioneering: *Crystal Ball Users Manual 2000.2.* Denver, CO: Decisioneering, Inc., 1998.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

DeRoo LA, Rautiainen RH: A systematic review of farm safety interventions. *American Journal of Preventive Medicine*, 18(4 Suppl): 51-62, 2000.

Dimich-Ward H, Guernsey JR, Pickett W, Rennie D, Hartling L, Brison RJ: Gender differences in the occurrence of farm-related injuries. *Occupational and Environmental Medicine*, 61: 52-56, 2004.

Dosemeci M, Wacholder L, Lubin JH: Does nondifferential misclassification of exposure always bias a true effect toward the null value? *American Journal of Epidemiology*, 132: 746-748, 1990.

Elkington JM: *A Case-Control Study of Farmwork Related Injuries in Olmsted County, Minnesota.* Doctoral Dissertation, Minneapolis, Minnesota: University of Minnesota, 1990.

Farmer JE, Peterson L: Injury risk factors in children with attention deficit hyperactivity disorder. *Health Psychology*, 14(4): 325-332, 1995.

Field A: *Discovering Statistics Using SPSS for Windows. Exploratory Factor Analysis.* London: Sage Publications, 2000.

Flegal KM, Keyl PM, Nieto FJ: Differential misclassification arising from nondifferential errors in exposure measurement. *American Journal of Epidemiology*, 134: 1233-1244, 1991.

Floyd FJ, Wideman KF: Factor analysis in the development and refinement of clinical assessment instruments. *Psychological Assessment*, 7: 286-289, 1995.

French LR, Carr P, Gerberich SG, Gunderson P, Gibson R, Melton LJ III, Elkington JM: Reliability of "E"-coding farm-related injuries using the *International Classification of Diseases,* ninth revision (ICD-9) and a modified version of ICD-9. *American Journal of Epidemiology*, 130(4): 826, 1989.

Gabel C: *A Study of Risk Factors for Injuries among Minnesota Veterinarians.* Doctoral Dissertation, Minneapolis, Minnesota: University of Minnesota, 2000.

Gerberich SG, Priest JD, Boen JR, Straub CP, Maxwell RE: Concussion incidence and severity in secondary school varsity football players. *American Journal of Public Health*, 73(12): 1370-1375, 1983.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Gerberich SG, Finke R, Madden, Priest JD, Aamoth G, Murray K: An epidemiological study of high school ice hockey injuries. *Child's Nervous System*, 3:59-64, 1987.

Gerberich SG, Gibson RW, Gunderson PD, French LR, Melton LJ III, Erdman A, Smith P, True JA, Carr WP, Elkington J, Renier CM, Andreasson LR: *The Olmsted Agricultural Trauma Study (OATS): A population-based effort.* Report to the Centers for Disease Control and Prevention. Minneapolis, Minnesota: Regional Injury Prevention Center, University of Minnesota, 1991.

Gerberich SG, Gibson RW, Gunderson PW, Melton LJ III, French LR, Renier CM, Erdman AG, True JA, Carr WP, Elkington JM: Validity of trauma reporting in the agricultural community. *Journal of Occupational Accidents*, 12: 200, 1990.

Gerberich SG, Gibson RW, French LD, Carr P, Renier CM, Gunderson P, Martin F, True J, Shutske J, Brademeyer K: *The Regional Rural Injury Study – I (RRIS–I): A population-based effort.* A Report to the Centers for Disease Control and Prevention. Minneapolis, Minnesota: Regional Injury Prevention Center, University of Minnesota, 1993.

Gerberich SG, Gibson RW, French LR, Renier CM, Lee T-Y, Carr WP, Shutske J: Injuries among farm children and youth in farm households: Regional Rural Injury Study – I (RRIS–I). *Injury Prevention*, 7: 117-122, 2001.

Gerberich SG, Gibson RW, French LR, Church TR, Alexander BH, Shutske J, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR, Zhang X, Jensen KE: *Etiology and consequences of injuries among children in farm households: A regional rural injury study.* A report to the Centers for Disease Control and Prevention. Minneapolis, Minnesota: Regional Injury Prevention Center, University of Minnesota, 2003.

Gerberich SG, Alexander BH, Church TR, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR: *Regional Rural Injury Study – II, Phase 2: Agricultural Injury Surveillance.* A report to the Centers for Disease Control and Prevention. Minneapolis, Minnesota: Regional Injury Prevention Center, University of Minnesota, 2004.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Gilbert ES: Does nondifferential misclassification of exposure always bias a true effect toward the null value? *American Journal of Epidemiology*, 134: 440-441, 1991.

Greenland S, Pearl J, Robins JM: Causal diagrams for epidemiologic research. *Epidemiology*, 10(1): 37-48, 1999.

Greenland S: Randomization, statistics, and causal inference. *Epidemiology*, 1: 421-429, 1990.

Greenland S: *Validity concepts in epidemiologic research.* UCLA Department of Epidemiology technical report, 1994.

Hendricks KJ, Layne LA, Goldcamp EM, Myers JR: Injuries to youth living on U.S. farms in 2001 with comparison to 1998. *Journal of Agromedicine*, 10(4): 19-26, 2006.

Hernán MA, Hernández-Díaz S, Werler MM, Mitchell AA: Causal knowledge as a prerequisite for confounding evaluation: An application to birth defects epidemiology. *American Journal of Epidemiology*, 155(2): 176-184, 2002.

Horvitz DG, Thompson DJ: A generalization of sampling without replacement from a finite universe. *Journal of the American Statistical Association*, 47(260): 663-685, 1952.

Ialongo NS, Kellam SG, Poduska,J: *Manual for the Parent Observation of Child Adaptation (Tech. Rep. No. 3).* Baltimore, MD: Johns Hopkins University, 1999.

Kelsey JL, Whittemore AS, Evans AS, Thompson WD: *Methods in observational epidemiology. Second Edition*, New York: Oxford University Press, 1996.

Kleinbaum DG, Kupper LL, Morgenstern H: *Epidemiologic research: Principles and quantitative methods.* Belmont, CA: Lifetime Learning Publications, 1982.

Landry LG: Preventing occupational injuries: women's perception of risk from musculoskeletal exposures. *American Association of Occupational Health Nurses Journal*, 54(2): 75-83, 2006.

Layde PM, Stueland DT, Nordstrom DL: Representativeness of trauma center registries for farm injury surveillance. *Accident Analysis and Prevention*, 28(5): 581-586, 1996.

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Lee BC, Westaby JW, Berg RL: Impact of a national rural youth health and safety initiative: Results from a randomized controlled trial. *American Journal of Public Health*, 94(10): 1743-1749, 2004.

Lee T-Y, Gerberich SG, Gibson RW, Carr WP, Shutske J, Renier CM: A population-based study of tractor-related injuries: Regional Rural Injury Study - I (RRIS - I). *Journal of Occupational and Environmental Medicine*, 38(8): 782-793, 1996.

Liang K-Y, Zeger SL: Longitudinal data analysis using generalized linear models. *Biometrika*, 73: 13-22, 1986.

Lilley R, Feyer AM, Langley J, Wren J: The New Zealand child work-related fatal injury study: 1985-1998. *New Zealand Medical Journal*, 117(1194): U891, 2004.

Low JM, Griffith GR, Alston CL: Australian farm work injuries: Incidence, diversity, and personal risk factors. *Australian Journal of Rural Health*, 4(3): 179-189, 1996.

Macarthur C, Dougherty G, Pless IB: Reliability and validity of proxy respondent information about childhood injury: An assessment of a Canadian surveillance system. *American Journal of Epidemiology*, 145(9): 834-841, 1997.

Maldonado G: Interpreting epidemiologic studies. In: *Environmental Epidemiology.* Advances in Chemistry Series, Draper W., Editor, No. 241, American Chemical Society Books, 1993.

Maldonado G: Adjusting a relative-risk estimate for study imperfections. Unpublished Manuscript, 2006.

Mongin SJ: *Adjustment for non-response in the Minnesota Nurses Study.* Health Studies Research Report (http://www1.umn.edu/eoh/NewFiles/resreports.html). Division of Environmental Health Sciences, University of Minnesota, Minneapolis, Minnesota, 2001.

Myers JR, Hard DL: Work-related fatalities in the agricultural production and services sectors, 1980-1989. *American Journal of Industrial Medicine*, 27: 51-63, 1995.

Nordstrom DL, Layde PM, Olson KA, Stueland DT, Brand L, Follen MA: Incidence of farm-work-related acute injury in a defined population. *American Journal of Industrial Medicine*, 28(4): 551-564, 1995.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Pickett WL, Hartling L, Brison RJ, Guernsey JR: Fatal work-related farm injuries in Canada, 1991-1995: Canadian Agricultural Injury Surveillance Program. Canadian *Medical Association Journal*, 160(13): 1843-1848, 1999.

Pickett WL, Hartling L, Dimich-Ward H, Guernsey JR, Hagel L, Voaklander DC, Brison RJ: Surveillance of hospitalized farm injuries in Canada. *Injury Prevention*, 7: 123-128, 2001.

Potter BK, Speechley KN, Koval JJ, Gutmanis IA, Campbell MK, Manuel D: Socioeconomic status and non-fatal injuries among Canadian adolescents: variations across SES and injury measures. BMC Public Health, 12(5): 132, 2005.

Pratt DS, Marvel LH, Darrow D, Stallones L, May JJ, Jenkins PL: The dangers of dairy farming: the injury experience of 600 workers followed for two years. *American Journal of Industrial Medicine*, 21(5): 637-50, 1992.

Rasmussen K, Carstensen O, Lauritsen JM: Incidence of unintentional injuries in farming based on one year of weekly registration on Danish farms. *American Journal of Industrial Medicine*, 38(1): 82-89, 2000.

Rothman KJ, Greenland S: *Modern Epidemiology, Second Edition*. Philadelphia: Lippincott-Raven, 1998.

Rowe R, Maughan B, Goodman R: Childhood psychiatric disorder and unintentional injury: Findings from a national cohort study. *Journal of Pediatric Psychology*, 29(2): 119-130, 2004.

SAS. *SAS OnlineDoc[R], Version 8*. SAS Institute, Inc, 2000.

Schlesselman JJ: *"Sample Size" in Case-Control Studies: Design, Conduct, Analysis.* New York, NY: Oxford University Press, pp.144-170, 1982.

Schwartz S, Eidelman AI, Zeidan A, Applebaum D, Raveh D: Childhood accidents: the relationship of family size to incidence, supervision, and rapidity of seeking medical care. *Israel Medical Association Journal*, 7(9): 558-563, 2005.

SPSS. *SPSS: Version 12.0 for Windows*. Chicago: Author, 2003.

Stallones L: Surveillance of fatal and non-fatal farm injuries in Kentucky. *American Journal of Industrial Medicine*, 18(2): 223-34, 1990.

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Stallones L, Keefe TJ, Xiang HY: Characteristics associated with increased farm work-related injuries among male resident farm operators in Colorado, 1993. *Journal of Agricultural Safety and Health*, 3(3): 195-201, 1997.

Steenland K, Halperin W, Hu S, Walker JT: Deaths due to injuries among employed adults: the effects of socioeconomic class. *Epidemiology*, 14(1): 74-79, 2003.

Stueland D, Lee B, Layde PM: Surveillance of agricultural injuries in Central Wisconsin: Epidemiologic characteristics. *Journal of Rural Health*, 78(1): 63-71, 1991.

Stueland D, Lee B, Nordstrom DL, Layde PM, Wittman LM: A population-based case-control study of agricultural injuries in children. *Injury Prevention*, 2: 192-196, 1996.

Stueland D, Lee B, Nordstrom DL, Layde PM, Wittman LM, Gunderson PD: Case-control study of agricultural injuries to women in central Wisconsin. *Women's Health*, 25(4): 91-103, 1997.

US Census Bureau: *American FactFinder*. (http://factfinder.census.gov/servlet/CTGeoSearchByListServlet?ds_name=DEC_2000_SF1_U&_lang=en&_ts=171123314000), 2005.

US Department of Agriculture, National Agricultural Statistics Service: *Farm Numbers and Land in Farms: Final estimates*, 1998-2002. (http://usda.mannlib.cornell.edu/usda/reports/general/sb/sb991.pdf), 2004.

US Department of Agriculture, National Agricultural Statistics Service: *Minnesota Agricultural Statistics*. (http://www.nass.usda.gov/mn/agstat02/p00i018.pdf), 2002.

Vose D: *Risk Analysis. A Quantitative Guide, 2nd Edition*. New York, NY: John Wiley & Sons, LTD, 2000.

Wacholder S, Dosemeci M, Lubin JH: Blind assignment of exposure does not always prevent differential misclassification. *American Journal of Epidemiology*, 134: 433-437, 1991.

Wang X, Wang PS, Zhou W: Risk factors of military training-related injuries in recruits of Chinese People's Armed Police Forces. *Chinese Journal of Traumatology*, 6(1): 12-17, 2003.

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Wennberg P, Bohman M: The timeline follow back technique: Psychometric properties of a 28-day timeline for measuring alcohol consumption. *German Journal of Psychiatry*, 2: 62-68, 1998.

Woodward A, Douglas B, Miles H: Chance of free dinner increases response to a mail questionnaire. *International Journal of Epidemiology*, 14(4): 641-642, 1985.

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TABLE 1

Comparison of Odds Ratios and 95% Confidence Intervals from Select Multivariable Regression Models – Phase 1 (1999), Phase 2 (2001), and Combined Data Sets:

Regional Rural Injury Study – II (RRIS-II)

MULTIVARIABLE MODELS*	DATA SET		
Exposure-Injury Odds[a]	**1999**	**2001**	**Combined**
Operated Tractors			
Yes	1.8 (1.1–2.9)	1.7 (1.0–2.8)	1.7 (1.2–2.4)
No	Referent	Referent	Referent
Operated Large Machinery			
Yes	1.7 (1.1–2.8)	1.8 (1.1–2.9)	1.6 (1.2–2.3)
No	Referent	Referent	Referent
Worked with Beef Cattle			
Yes	2.3 (1.5–3.6)	2.2 (1.4–3.5)	2.3 (1.7–3.1)
No	Referent	Referent	Referent
Behavior–Injury Odds[b]			
Liked to Plan Carefully			
Almost Never/Sometimes	1.4 (1.0–2.0)	1.2 (0.8–1.7)	1.3 (1.0–1.7)
Almost Always/Often	Referent	Referent	Referent
Was Cautious			
Almost Never/Sometimes	1.6 (1.0–2.7)	1.4 (0.9–2.1)	1.4 (1.0–1.9)
Almost Always/Often	Referent	Referent	Referent
Depression			
High	2.5 (1.1–5.7)	1.6 (0.7–3.9)	1.8 (1.0–3.3)
Medium	0.9 (0.6–1.4)	1.1 (0.7–1.7)	1.1 (0.8–1.4)
Low	Referent	Referent	Referent
Aggression			
High	1.4 (0.6–3.5)	2.5 (1.1–5.4)	1.9 (1.1–3.2)

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Medium	1.1 (0.7–1.7)	1.1 (0.7–1.7)	1.1 (0.8–1.5)
Low	Referent	Referent	Referent
Behavior–Operated Tractor Odds[b]			
Liked to Plan Carefully			
Almost Never/Sometimes	1.3 (0.8–2.0)	1.2 (0.8–1.8)	1.2 (0.9–1.6)
Almost Always/Often	Referent	Referent	Referent
Was Cautious			
Almost Never/Sometimes	0.8 (0.5–1.5)	0.7 (0.4–1.0)	0.7 (0.5–1.0)
Almost Always/Often	Referent	Referent	Referent
Depression			
High	0.9 (0.3–3.3)	1.1 (0.5–2.5)	1.0 (0.5–2.1)
Low	Referent	Referent	Referent
Aggression			
High	1.3 (0.5–3.7)	1.2 (0.5–2.9)	1.1 (0.6–2.2)
Low	Referent	Referent	Referent
Parent Injury–Child Injury Odds[†]			
Father Injured Prior to 1999[c]			
Yes	2.1 (1.5–3.0)	2.0 (1.4–2.9)	1.9 (1.5–2.4)
No	Referent	Referent	Referent
Mother Injured Prior to 1999[d]			
Yes	2.5 (1.7–3.8)	2.0 (1.3–2.9)	2.2 (1.6–2.9)
No	Referent	Referent	Referent

* Models included children ages six to <20 years, and were adjusted for within-household correlation using GEEs (Liang and Zeger, 1986) and weighted for non-response (Horvitz and Thompson, 1952; Mongin, 2001)

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† Models included all children (aged <20 years), and were adjusted for within-household correlation using GEEs (Liang and Zeger, 1986) and weighted for non-response (Horvitz and Thompson, 1952; Mongin, 2001).

a. Model covariates included gender, age, body mass index, number of hours worked on operation, parents' average age, parents' highest education level, number of children in household, operation state, operation type, and operation income

b. Model covariates included gender, age, body mass index, number of hours worked on operation, parents' average age, parents' highest education level, number of children in household, operation state, operation type, and operation income

c. Model covariates included state, type of agricultural operation, number of children in the household, fathers' age and education level, and total household hours worked on the operation

d. Model covariates included state, type of agricultural operation, number of children in the household, mothers' age and education level, and total household hours worked on the operation

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TABLE 2

Causal Model Variables and Relationships Assumed in Current Analyses:

Regional Rural Injury Study – II (RRIS-II)

Variable	Definition	Affects	Rationale
Child's Age	Age on 1/01 from HH Roster -Based on best information	Behavior Exposures Children's Risk of Injury	Developmental Theory and Prior Research: Gerberich et al., 1993; 2001; 2003; 2004; Brison et al., 2006; Hendricks et al., 2006; Lilley et al., 2004
Child's Gender	Gender of Subject from HH Roster: 1 = Male; 3 = Female	Behavior Exposures Children's Risk of Injury	Developmental Theory and Prior Research: Gerberich et al., 1993; 2001; 2003; 2004; Cogbill et al., 1991; Dimich-Ward et al., 2004; Pickett et al., 1999; Stueland et al., 1991; Pratt et al., 1992; Stallones, 1990
Child's Body Mass Index	Weight in kilograms/height in meters-squared: gender- and age-adjusted	Behavior Exposures Children's Risk of Injury	Developmental Theory and Prior Research: Gerberich et al., 1983; 1987; Low et al., 1996; Wang et al., 2003

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Child's Number of Hours Worked per Week	Hrs/wk farm work in month before target month 0 = None 999 = Missing/Unknown/Refused	Behavior Exposures Children's Risk of Injury	Prior Research: Gerberich et al., 1993; 2001; 2003; 2004; Boyle et al., 1997; Elkington, 1990; Stueland et al., 1996; Stueland et al., 1997
Parents' Age	Age on 1/01-Based on best information	Behavior Exposures Parent Injury Children's Risk of Injury	Prior Research: Gerberich et al., 2003; 2004; Cogbill et al., 1991; Nordstrom et al., 1995; Pickett et al., 1999; Pratt et al., 1992; Myers & Hard, 1995
Parents' Education Level	Head-of-HH Highest Grade as of 1/01: 0 = < Kindergarten/<5 years old; 1 = 8th grade or less; 2 = Some high school; 3 = High school grad/GED; 4 = Some technical school; 5 = Technical school grad; 6 = Some college; 7 = College grad; 8 = Graduate School; 9 = Other; 77 = N/A - Not in household; 99 = Missing, Unknown, or Refused	Behavior Exposures Parent Injury Children's Risk of Injury	Prior Research: Gerberich et al., 2003; 2004; Bancej & Arbuckle, 2000; Lee et al., 1996;

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Number of Children in Household	Sum of household members <20 years of age	Behavior Exposures Parent Injury Children's Risk of Injury	Prior Research: Gerberich et al., 2003; 2004; Celis et al., 2003; Landry, 2006; Schwartz et al., 2005
Operation State	Code for State of Operations: 27 = MN; 31 = NE; 38 = ND; 46 = SD; 55 = WI	Behavior Exposures Parent Injury Children's Risk of Injury	Prior Research: Gerberich et al., 2003; 2004
Operation Type	Enterprise with most work time: 0 = Nothing during that month; 1 = Beef cattle; 2 = Dairy cattle; 3 = Other animals; 4 = Field, forage, or specialty crops; 5 = CRP; 9 = Missing, Unknown, or Refused	Behavior Exposures Parent Injury Children's Risk of Injury	Prior Research: Gerberich et al., 1993; 2001; 2003; 2004; Bancej and Arbuckle, 2000; Layde et al., 1996; Lee et al., 1996; Nordstrom et al., 1995; Rasmussen et al., 2000; Stallones et al., 1997; Stueland et al., 1997
Operation Income	Estimated 1998/2000 household income: 1 = Less than $15,000; 2 = $15,000-$29,999; 3 = $30,000-$49,999; 4 = $50,000-$99,999; 5 = $100,000-$174,999; 6 =	Behavior Exposures Parent Injury Children's Risk of Injury	Prior Research: Chen et al., 2005; Cubbin et al., 2000; Elkington, 1990; Potter et al., 2005; Steenland et al., 2003

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	$175,000-$249,999; 7 = $250,000+; 9 = Missing, Unknown, or Refused		
Behaviors	In target month, child… completed work/chores; followed rules; worked hard; planned carefully before going ahead; was cautious; paid attention; had good concentration; acted without thinking; got into fights; was impulsive; broke rules; couldn't sit still; was easily distracted; was irritable; left the house or farm without permission; looked sad or down; bullied or was mean to others; had low energy: 1 = Almost never; 2 = Sometimes; 3 = Often; 4 = Almost always; 7 = NA (<5 years of age); 9 = Missing, Unknown, or Refused	Exposures Parent Injury Children's Risk of Injury	Aims 1 and 2 of Current Analyses. Prior research includes: Caspi et al., 1997; Davidson, 1987; 1992; Farmer and Peterson, 1995; Rowe et al., 2004
Exposures	In target month, child…worked with horses, beef cattle, or sheep; drove or rode as a passenger in motor vehicles; operated	Parent Injury Children's Risk of Injury	Prior Research: Gerberich et al., 2003; 2004

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	tractors; worked with dairy cattle, swine, or poultry; rode on tractors; worked with large machinery or small equipment: 0 = No; 1 = Yes; 9 = Missing, Unknown, or Refused		
Parent Injury	Any injuries in study year: 0 = No; 1 = Yes; 9 = Missing, Unknown, or Refused	Children's Risk of Injury	Aim 3 of Current Analyses. Prior research includes: Carlson et al., 1996; Elkington, 1990; Boyle, 1995
Risk of Injury	Case/Control Status: 0 = Control; 1 = Case		General Aim of Current Analyses

TABLE 3

Estimation of Minimum Detectable Risk Levels* for Select Variables:

Regional Rural Injury Study – II (RRIS-II)

Study Population	Cases†	Variable	Prevalence‡	Minimum Detectable Risk
TOTAL	379	Distractibility	0.099	1.44
TOTAL	379	Impulsivity	0.091	1.46
TOTAL	379	Cautiousness	0.190	1.33
TOTAL	379	Operated Tractors	0.282	1.29
TOTAL	379	Operated Machinery	0.212	1.32
TOTAL	379	Worked with Beef Cattle	0.329	1.28
TOTAL	379	Both Parents Sustained Injuries Prior to 1999	0.117	1.40

* Based on Equation 6.11 in Schlesselman (1982)

† Case children ages six to <20 years of age in combined data set

‡ Exposure prevalence among controls ages six to <20 years of age in combined data set

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FIGURE 1

Conceptual Framework for Analysis of Associations between Behaviors, Exposures, and Intra-familial Agricultural Injuries: Regional Rural Injury Study – II (RRIS-II)

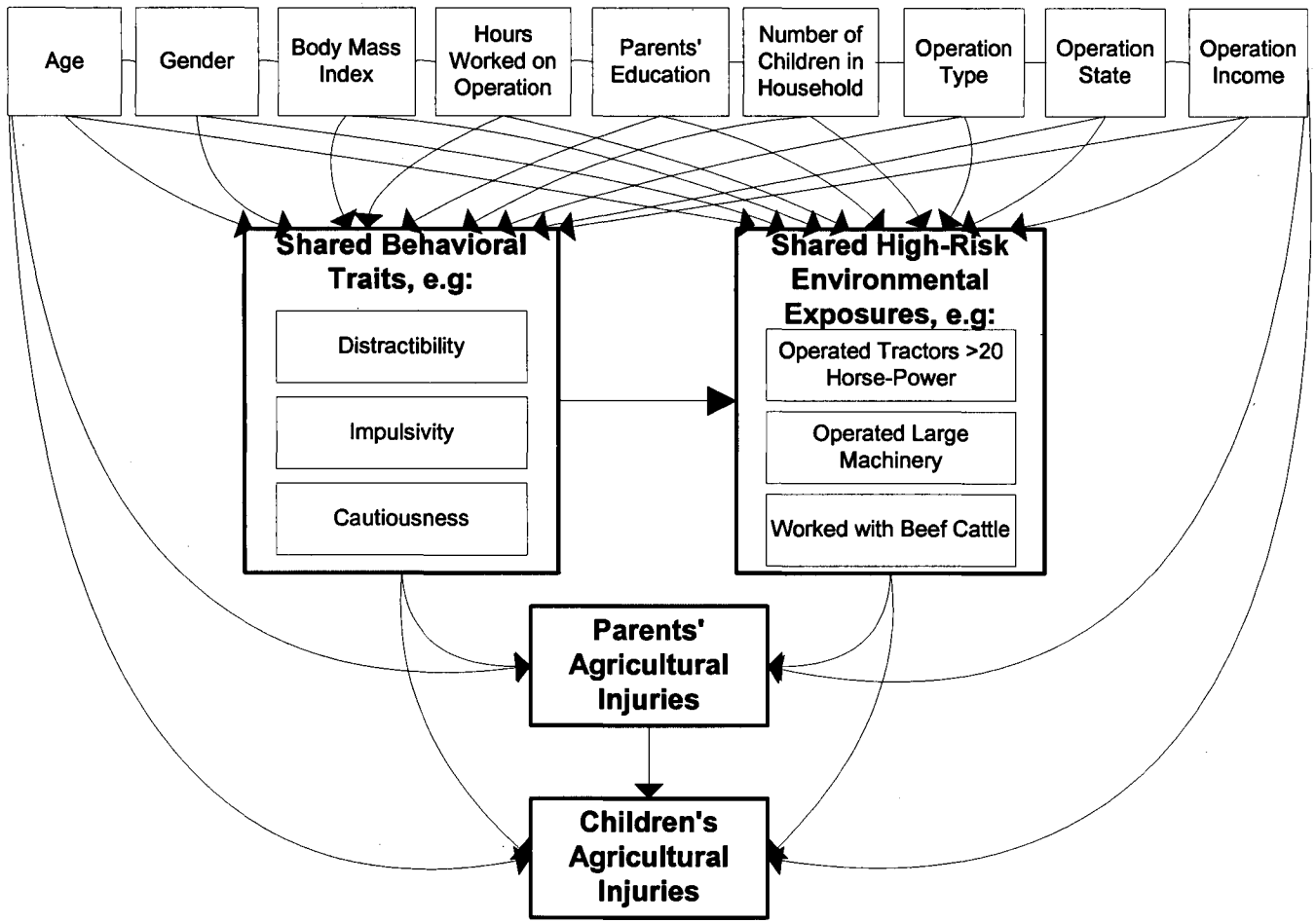

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FIGURE 2

Causal Model Identifying Hypothesized Associations between Children's Behaviors, Exposures, and Risk of Injury: Regional Rural Injury Study – II (RRIS-II)

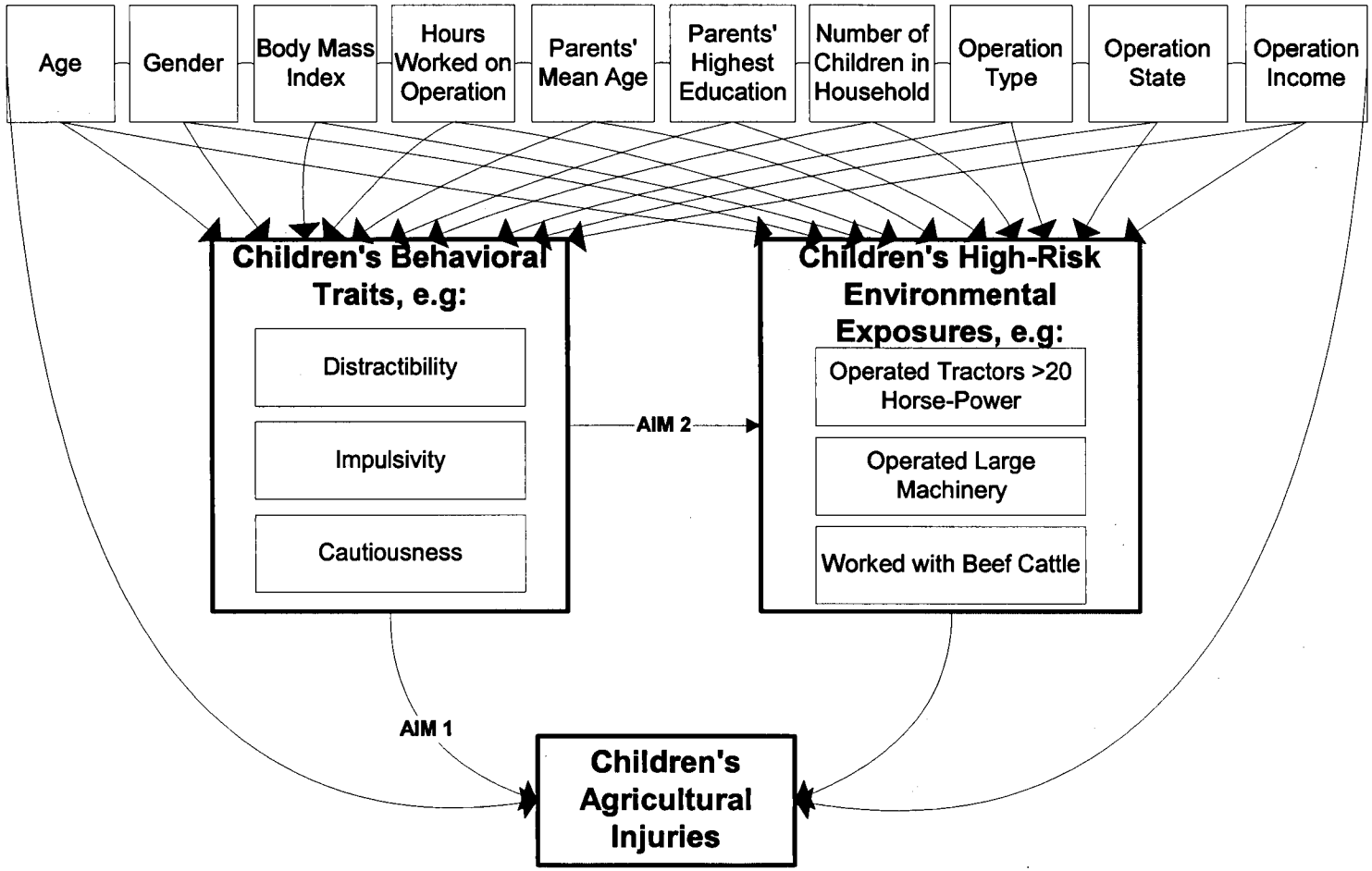

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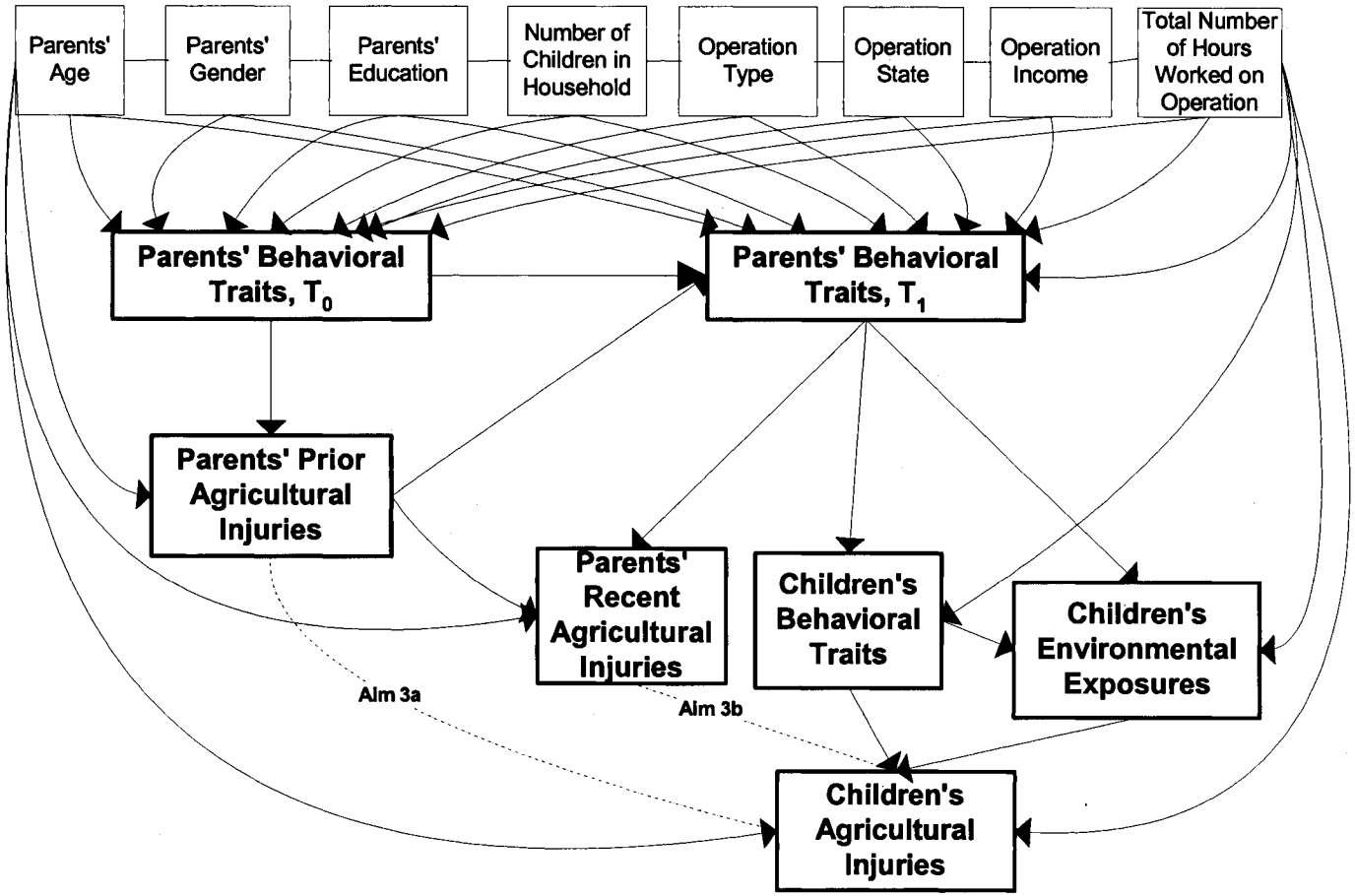
FIGURE 3

Causal Model Identifying Hypothesized Associations between Parents' and Children's Risk of Injury: Regional Rural Injury Study – II (RRIS-II)



CHAPTER IV

BEHAVIORAL RISK FACTORS FOR CHILDREN'S AGRICULTURAL INJURY

ABSTRACT

Children who work and/or live on family agricultural operations are at high risk of injury. While environmental exposures are known to increase risk, the effect of behavior on risk of injury is not as thoroughly understood.

Data from the Regional Rural Injury Study–II, a population-based nested case-control study conducted in 1999 and 2001, were used to assess behavioral risk factors for injury to children ages six to <20 years. Computer-assisted telephone interviews aided collection of demographic, behavior, and injury data for six-month recall periods. A total of 379 injury events (cases) and 1,562 randomly-selected controls were identified. Injury risk was estimated in reference to behavioral items, adapted primarily from the Parent Observation of Child Adaptation checklist, and scores for five scales, based on *a priori* constructs and exploratory factor analysis. Odds ratios (OR) and 95% confidence intervals (CI) were calculated using logistic regression, controlling for potential confounders selected by means of directed acyclic graphs.

Results indicated increased risks of injury for children who almost never/sometimes (versus almost always/often): were cautious, planned carefully, and followed rules (OR=1.6, CI=1.1–2.3; OR=1.3, CI=0.9–1.7; and OR=1.5, CI=0.9–2.5; respectively); while decreased risks were observed for those who almost never/sometimes (versus almost always/often): worked hard, and paid attention (OR=0.6, CI=0.3–0.9 and OR=0.7, CI=0.4–1.1). Similarly, children who almost always/often got into fights or broke rules had increased risks (OR=1.9, CI=0.9–3.8 and OR=2.0, CI=0.9–4.4). Elevated risks of injury were also identified for children with high levels of depressive symptoms (OR=1.9, CI=1.0–3.7) and aggression (OR=1.6, CI=0.9–2.7), and for low levels for being careful/cautious (OR=1.8, CI=1.1–2.9). Those with low and medium levels of self-regulation had reduced risks of injury (OR=0.4, CI=0.2–0.8 and OR=0.7, CI=0.5–1.0, respectively), compared to children with high levels.

These results suggest that children's behaviors affect their risk of agricultural injury. Additional research could elucidate mechanisms and inform interventions.

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BACKGROUND

Agriculture is among the most hazardous industries in the United States (US), with rates of fatal injuries more than eight times greater than all occupations combined (National Safety Council, 2006). Unlike other industrial settings, the proximity between households and agricultural operations leads to unprecedented rates of pediatric mortality, morbidity, and disability among agricultural families (Rivara, 1997; Pickett et al., 2001). Sociocultural characteristics of the rural agricultural population (Kelsey, 1994; Kim and Zepeda, 2004), such as the use and importance of child labor for agricultural tasks (Lee et al., 1997), are also important factors that contribute to elevated rates of fatal and nonfatal agricultural injury among children.

Exposures to specific environmental hazards, such as tractors, machinery, and various types of animals, have been shown to increase children's risk of injury on agricultural operations (Gerberich et al., 2001). Behavioral risk factors, however, have not been well characterized in this population. Prior research has shown behavioral traits, such as distractibility or impulsivity, to be positively associated with children's risk of injury (Schwebel and Plumert, 1999; Bijur et al., 1986; Jaquess and Finney, 1994), while traits such as overactivity, inattentiveness, aggression, and impulsivity have been found to be independent risk factors for injury among people of all ages (Bijur et al., 1986; Davidson, 1987; Jaquess and Finney, 1994; Wazana, 1997). How such behaviors might influence risk of agricultural injury among farm and ranch families is unknown.

In recent years, the study of behavioral risk factors has subsided in favor of a more resolute focus on environmental hazards and passive interventions. However, given that this approach has had limited success in the agricultural community (DeRoo and Rautiainen, 2000; Hartling et al., 2004), with its unique values and work traditions (Elder and Conger, 2002), a multifaceted approach to children's agricultural injury is warranted. Improved knowledge of the role of children's behaviors on their risk of agricultural injury could enhance current and future intervention efforts. The purpose of the current study was to analyze associations between reported behavioral traits among children ages

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six to <20 years and their risk of agricultural injury on family farming and ranching operations.

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METHODS

Overview

This study was based on data from Phase 1 (1999) and Phase 2 (2001) of the Regional Rural Injury Study–II (RRIS–II). The RRIS–II was a prospective, population-based cohort study of agricultural households in Minnesota, North Dakota, South Dakota, Nebraska, and Wisconsin. For the current analysis, data from the two cohorts involving all ages, as well as nested case-control studies involving children, were used. The Institutional Review Board, Human Subjects Committee, at the University of Minnesota approved the protocol for both study phases and the current analyses.

Study Population

The US Department of Agriculture (USDA) National Agricultural Statistics Service Master ListFrame of Farming Operations provided the roster of farming and ranching operations. For each phase, random samples of 3,200 agricultural operations were selected for each of the five states, providing a total of 16,000 selected operations per year. To be eligible for the study, operations had to: 1) have a household associated with the operation that included children <20 years of age in residence as of January 1st of each year; 2) produce at least $1,000 of agricultural goods in the year prior to each study phase, or be involved in a Conservation Reserve Program (CRP); and 3) be actively farming/ranching as of January 1st of the respective years.

Data Collection

Subsequent to an introductory mailing in January of each study year, telephone interviews were conducted, using a computer assisted telephone interview (CATI) instrument, to obtain informed consent, establish eligibility, and enroll eligible households that were willing to participate in the study. Eligible participating households were mailed comprehensive packets of information containing: (1) cover letters from the study investigators and respective state USDA offices; and, (2) booklets with detailed information to facilitate telephone interviews, and logs to maintain ongoing information about injury events between January 1st and June 30th. Comparable mailings were implemented for the second six months of data collection (July 1st – December 31st).

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Full-length CATI interviews began in July of each year, and January of the following years, to collect data for the respective prior six-month periods. The female head of household was the preferred informant for the collection of demographic, behavioral, and injury data, while the male head of household was preferred for operation exposure information. For the nested case-control studies, children 12 years and older were their own respondents for exposure information. The proxy for those who refused, and children younger than 12 years, was the female head of household.

Case and Control Selection

Cases were all agricultural injury events associated with their own operation and sustained during the reporting periods by children under 20 years of age. The control population came from households randomly sampled to achieve a minimum ratio of three controls per case. To account for seasonal trends in injury incidence, injury rates from the most recent, similar study were used to estimate the number of controls needed: Phase 1 selection was based on data from the Regional Rural Injury Study – I (RRIS–I) (Gerberich et al., 1993) while Phase 2 selection was based on Phase 1 data (Gerberich et al., 2003). An incidence-density sampling scheme was used to sample from the agricultural injury-free person-time experience (months) of children <20 in residence on the operation. One child with at least one agricultural injury-free month was randomly selected from each sampled household. Behavior and exposure data were collected for the month before the month of injury for cases, and the month before an agricultural injury-free month for controls, sampled to reflect expected monthly incidence rates. This method allowed cases to be sampled as controls for months in which they did not sustain an agricultural injury.

Behavioral Items and Scales

For case and control children ages six to <20 years, responses were elicited for 18 behavioral items adapted from commonly used inventories; most were from the Parent Observation of Child Adaptation (POCA) checklist (Ialongo et al., 1999). Items were in the form of a four-point Likert scale and addressed various behaviors, e.g., "[Child's name] almost never, sometimes, often, or almost always: completed work/chores; followed rules; worked hard; planned carefully before going ahead; was cautious; paid

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attention; had good concentration, acted without thinking; got into fights; was impulsive; broke rules; couldn't sit still; was easily distracted; was irritable; left the house or farm without permission; looked sad or down; bullied or was mean to others; and, had low energy."

These items were used to form behavioral scales relevant to the agricultural population. Hypothesized *a priori* constructs, based on POCA scales from which items were selected, were modified based on results of exploratory factor analysis (Field, 2000; Floyd and Wideman, 1995). Maximum likelihood analyses with promax oblique rotations were performed using SPSS version 12.0 for Windows (SPSS, 2003). Factors with eigenvalues greater than 1.0 and items with absolute values greater than 0.40 for factor loadings were retained for subsequent, iterative analyses. Cronbach's alphas were used as a test of internal consistency for resulting scales (Cronbach, 1951).

Five scales were developed using this approach: (1) Depression: Child looked sad or down; had low energy; was irritable (Cronbach's alpha = 0.58), (2) Aggression: Child broke rules; got into fights; was impulsive (alpha = 0.51), (3) Self-Regulation: Child was easily distracted; paid attention; had good concentration; worked hard (alpha = 0.78), (4) Careful/Cautious: Child was careful; was cautious (alpha = 0.58), and (5) Responsible Conduct: Child completed work; followed rules (alpha = 0.60).

Individual behavioral items were dichotomized to allow comparisons of children who almost always or often exhibited the behavior (almost always/often), versus those who almost never or sometimes did (almost never/sometimes). Item responses were reversed, where appropriate, for the five scalar constructs. Distributions were skewed and, thus, scores were categorized to compare children with the least desirable level of the behavior (to the extent possible, those within the 10^{th} percentile tail) to those with more moderate (10^{th} to $<50^{th}$ percentile) and desirable (50^{th} to 100^{th} percentile) levels. Depending on the direction of the scale, these categories are herein referenced as "high," "medium," and "low."

Data Analysis

Multivariable logistic regression was used to estimate risk of children's agricultural injury, in reference to behavioral items and scales, while controlling for

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potentially confounding variables (Breslow and Day, 1987). Odds ratios (OR) and 95% confidence intervals (CI) were calculated using logistic regression. Two models were analyzed: one estimated children's risk of injury while controlling for age and gender; and the second included age and gender, in addition to further potential confounders. To identify potential confounders, a causal model (Figure 1) was used as a basis for the design and use of directed acyclic graphs (DAGs), following the methods described by Greenland et al. (1999) and illustrated by Hernán et al. (2002). The DAGs were also used to identify covariates that may introduce bias if included in the statistical models, and to reduce potential for over-fitting.

Odds ratios were adjusted for within-household correlation using generalized estimating equations (GEEs; Liang and Zeger, 1986). Potential selection bias was controlled by inversely weighting observed responses with stratum-specific probabilities of response (Horvitz and Thompson, 1952), estimated as a function of characteristics available from the NASS database (state in which the operation was located; type of operation; annual revenue by quintile). To account for unknown eligibility among non-respondents, probability of eligibility was estimated for these same characteristics and used to adjust weights (Mongin, 2001). Data analyses were performed with SAS version 9.1 for Windows.

Bias Evaluation

Probabilistic uncertainty analyses were conducted to estimate the likely magnitude and direction of bias due to potential study errors, including residual confounding, measurement error, selection bias (sampling bias, losses to follow-up, non-response, and missing data), and specification bias. Using methods similar to those of Vose (2000) and described by Maldonado (unpublished manuscript, 2006), the robustness of each model was assessed while simultaneously accounting for estimated biases from each of these sources.

Assuming no other issues of validity, estimated odds ratios from this study were the products of true odds ratios (i.e., effects of behavioral traits on children's risk of agricultural injury), all bias factors, and random error. Using Crystal Ball Risk Analysis Software (Decisioneering, 1998), Monte Carlo simulations were used to forecast the

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product of the bias factors and, then, the distribution of probable true odds ratios for each independent variable. Priors were specified based on assumptions of the differential effects of the error sources on results for each analysis; priors are identified for select analyses in the study Addendum.

Briefly, values for residual confounding were centered at one but were allowed to vary by ten percent, assuming uniform distributions. Expecting recall bias to be the greatest source of measurement error; baseline mean values for correct recall were identified for each exposure, and allowed to vary for each cell in the respective 2x2 tables. Normal distributions with standard deviations equaling 10% of each value were also assumed. Sampling bias was calculated by centering mean values at one, assuming normal distributions with standard deviations of 0.10. For non-response, the average response proportion for each 2x2 table was set to equal 84.2% (the RRIS-II response rate), with slight variations across each cell. Distributions were assumed to be normal, had standard deviations equaling 10% of each value, and were truncated at 0 and one. Similar criteria were used to address case and control non-response. For missing exposure data, triangular distributions were used to forecast proportions of cases and controls likely to be exposed, with peak values set toward the maximum. Specification bias was considered by assigning normal distributions with mean values of one, but standard deviations of 0.10, for each cell. Effects of random error were not considered in these analyses.

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RESULTS

Based on analyses (Gerberich et al., 2003; 2004), population data from each phase were comparable and therefore combined for the current study. A total of 8,810 (28%) of the farms/ranches were found to be eligible and, of those, 7,420 (84%) participated in the respective full study. In total, 379 eligible cases (95%) and 1,562 eligible controls (97%) participated and were included in the analyses.

Participant Characteristics

Demographic and exposure characteristics of cases and controls are presented in **Table 1**. Case versus control children were more likely to be males (70% vs. 56%, respectively), have younger parents (62% vs. 50% between the ages of 35 and 44), reside in households with four or more children (22% vs. 13%), and reside in households associated with dairy cattle operations (22% vs. 13%). Control children tended to work fewer hours than cases, with 63% vs. 36% working <10 hours/week, 14% vs. 23% working 10 to <20 hours per week, and 9% vs. 19% working 20 to <30 hours per week. Cases and controls were comparable in terms of age- and gender-adjusted body mass index, parents' education, and operation income. With the exception of operation income (12%), missing responses were identified for <4% of each characteristic.

Regression Analyses

Behavioral Items

Results of multivariable regression analyses for behavioral items are presented in **Table 2**. Results were comparable between the model controlling for age and gender (data not shown), and the full multivariable model. Based on the causal model (**Figure 1**), the full model adjusted for numerous potential confounders (gender, age, body mass index, number of hours worked on operation, parents' average age, parents' highest education level, number of children in household, operation state, operation type, and operation income) and the 17 remaining behavioral items. Increased risks were identified for children who almost never/sometimes: liked to plan carefully (OR=1.3, CI=0.9–1.7); were cautious (OR=1.6, CI=1.1–2.3); or followed rules (OR=1.5, CI=0.9–2.5). Increased risks were also observed for children who almost always/often either broke rules

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(OR=2.0, CI=0.9–4.4) or got into fights (OR=1.9, CI=0.9–3.8). Reduced risks were observed for children who almost never/sometimes either worked hard (OR=0.6, CI=0.3–0.9) or paid attention (OR=0.7, CI=0.4–1.1).

Behavioral Scales

Four behavioral scales, depression, aggression, self-regulation, and careful/cautious, were associated with children's risks of agricultural injury (**Table 3**). While controlling for potential confounders, and the four remaining scales, children with high, versus low, levels of depressive symptoms had nearly twice the risk of injury (OR=1.9, CI=1.0–4.0) as did those with low levels of careful/cautious behavior (OR=1.8, CI=1.1–2.9). High scores for aggression also appeared to be associated with elevated injury risk (OR=1.6, CI=0.9–2.7). Contrarily, self-regulation was inversely associated with children's injury; those with low and medium levels had reduced risks, compared to those with high scores (OR=0.4, CI=0.2–0.8 and OR=0.7, CI=0.5–1.0, respectively).

Uncertainty Analyses

The magnitude and direction of the effects of the behavioral items and scales on children's risk of injury were largely unchanged when accounting for potential sources of study error. As identified in the **Addendum**, the high exposure level for depressive symptoms had a mean odds ratio estimate of 2.3, while low levels of self-regulation and careful/cautious behavior had mean estimates of 0.4 and 2.3, respectively. However, while mean ORs tended to be farther from the null than the adjusted multivariable ORs, identified in the Results section, the distributions of possible ORs for most behavioral items and scales included the null value of one. The ranges of possible ORs were 0.5–7.5 for high depressive symptoms, 0.3–0.6 for low self-regulation, and 0.5–7.3 for low careful/cautious behavior. Distribution charts for these examples are also identified (see **Addendum**).

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DISCUSSION

Rural agricultural households comprise a unique population due to distinct socio-cultural factors, hazardous exposures, and high rates of occupational injury, particularly among children. While previous studies have identified behavioral traits as potential risk factors for children's injuries, this study is distinct in that it explores behavioral items and scales that may drive the risk of agricultural injury among children in farming and ranching households.

Results suggest that children's behaviors were associated with their risk of agricultural injury. Increased risks of injury were identified for children who almost never/sometimes (versus almost always/often): were cautious, planned carefully, or followed rules; while reduced risks were noted for those who almost never/sometimes: worked hard or paid attention. Similarly, children who almost always/often got into fights or broke rules had increased risks of agricultural injury. Elevated risks were also identified for children with high levels of depressive symptoms, aggression, and self-regulation, and those with low levels for being careful/cautious.

Though some of the behavioral constructs examined appeared to have a unique interpretation for this population, these results were, in general, consistent with prior studies of behavior and injury. Across studies, aggression has been shown to be positively associated with risk of unintentional and intentional injuries, particularly among children (Krall, 1953; Mannheimer and Mellinger, 1967; Bijur et al., 1986). For example, a study of medically-treated, unintentional injuries among nearly 12,000 preschool children showed those in the 90^{th} percentile of aggression scores to have elevated risks for hospitalized and non-hospitalized injuries (Bijur et al., 1986). In the current study, children exhibiting high levels of aggression appeared to be at increased risk for agricultural injury, compared to children with low levels. This association may be due to increased risk-taking among those with aggressive personalities (Zuckerman and Kuhlman, 2000) which, on agricultural operations, could lead to more high-risk exposures than among children with lower tolerance for risk.

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An interesting finding, from the current study, was the association between agricultural injuries and symptoms of depression. Children in the highest 10^{th} percentile of combined depression-related scores had twice the risk as children with scores in the 50^{th} to 100^{th} percentile. To date, there has been limited evidence of any valid associations between depressive symptoms and risk of unintentional injury; a notable exception is a study by Peele and Tollerud (2005) which found that depression was associated with women's, though not men's, rates of occupational injuries. The current finding, pertinent to children of farming and ranching families, is highly relevant given the documented prevalence of depressive symptoms in this population (Fraser et al., 2005; Linn and Husaini, 1987; Scarth et al., 2000; Stallones et al., 1995).

Individual items as well as the averaged score for careful/cautious behavior were strongly associated with reduced risks of agricultural injury. These results were not surprising, given that children who are "planful" are less likely to engage in impulsive, risk-taking behavior (Caspi and Silva, 1995). This finding may, in part, reflect the contribution of a careful/cautious personality to the construct of conscientiousness. High scores for this trait, which includes "planful," in addition to dependability and prudence, have been shown to be associated with decreased fatal injuries in life-span survival analyses (Friedman, 2000). Further research has shown that conscientious parents have children who engage in less risk-taking behavior and are involved in fewer injury events (Morrongiello and House, 2004). On agricultural operations, children with conscientious, or careful/cautious, personalities might have decreased risks for a multitude of reasons. For example, these children might make use of current educational materials or prevention measures aimed at reducing risk of injury. Further development of this construct and its association with agricultural injury is warranted.

Though conclusions have been highly inconsistent, hyperactivity has been examined readily as a potential risk factor for children's injury (Davidson, 1987). Four items that comprise many hyperactivity scales (couldn't sit still; impulsive; acted without thinking; had good concentration) did not factor together in the current analyses, which suggests a distinct construct for these items within the agricultural community. The fact that the four individual items were not associated with injury seems to be consistent with

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most recent findings. While prior studies have shown activity-related measures to be associated with children's injury (Manheimer and Melinger, 1967; Langley et al., 1983; Bijur et al., 1986), findings from a more recent, prospective cohort study found no association between injury and overactivity, hyperactivity, or concentration problems (Davidson et al., 1988; 1992).

On the contrary, factor analysis identified four items (child was easily distracted; had problems paying attention; had good concentration; worked hard) that were strongly related, with a Cronbach's alpha of 0.78; this factor was referred to as children's self-regulation. A novel and important finding from this study was that children with low levels of self-regulation were at half the risk of agricultural injury as children with high scores for this construct. This is counter to previous studies showing low self-regulation, and its related measures, to be associated with risk-taking (Steinberg, 2004) and increased risk of injury (Manheimer and Mellinger, 1967). The current results, though surprising, may imply that parents supervise children with poor attention skills more closely. It is also conceivable that parents, well aware of attention problems in their children, are less likely to assign more hazardous or challenging work to children they know to be distractible or, concomitantly, are more likely to entrust children with good attention skills to chores they believe require better concentration.

Agricultural operations appear to present a unique context in which parent perceptions of individual child behavior and the nature of work available to children interact in complex ways. Further findings in this paper appear to reflect children's differential assignment to farm or ranch chores. For example, the item "child worked hard," appeared to play an important and distinct role in this particular study population. Working hard is, in general, a positive trait and was therefore expected to be inversely associated with injury. Interestingly, a direct association was observed; children who almost never/sometimes worked hard had reduced risks of injury. While children's work hours were controlled in the regression analysis, residual confounding due to differential work pace or high-risk types of work might explain this association. Future research examining the potential association between children's behavioral traits and their specific

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environmental exposures could further elucidate the causal pathway between children's behaviors and their risk of injury.

Strengths and Limitations

While this study addresses a deficiency in current knowledge about children's behavioral traits and agricultural injury, results should be interpreted in light of study limitations. Most importantly, analyses of behavioral items and injury data may have been susceptible to recall bias. This issue is particularly relevant to results pertinent to depression, given that these symptoms are commonly a result of injury (Keogh et al., 2000), but concern may also extend to other behavioral items and scales. While probabilistic uncertainty analyses indicated the magnitude and direction of most odds ratios to be largely unchanged in light of recall bias (in addition to other sources of error), there were limited data on which the specified priors could be based. Future studies that provide quantitative measurements of recall bias and other error factors, through validation studies or otherwise, would contribute substantially to this area of inquiry.

While this potential source of bias, as well as further measurement and selection issues, should be considered, multiple measures were taken to address these problems. Based on prior validation efforts (Gerberich et al., 1990; Braun et al., 1994), injury data were collected for six-month windows to limit information bias. Additionally, behavior-related items were measured in reference to the months prior to the injury events for cases, or randomly selected months for controls. Limited data, pertinent to agricultural operation state, size, and annual revenue by quintile, were also used in aggregate form to identify and adjust for differences in eligibility and response among households.

Given that a main intent of the RRIS–II was to serve as a tool for surveillance of environmental risk factors for agricultural injury, the behavioral items measured were limited in scope and number. The 18 items used were selected based on their deemed relevance to work and safety on agricultural operations. The *a priori* constructs, based mostly on the questionnaires from which the items were adapted, were modified based on results of exploratory factor analyses to yield the scales that were used; however, apart from self-regulation, Cronbach's alphas for each scale were relatively low. Low alphas

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may have resulted in part from the limited number of items included in each scale, but may also indicate limited interpretability for the factors used.

Conclusions

The development of multifaceted, sustainable approaches for prevention is necessary for this unique population. To date, there has been limited understanding of the impact of children's behavioral characteristics on their risk of unintentional injury. This study identified several behaviors as potential risk factors for agricultural injury. Specifically, children with symptoms of depression and aggression were found to have increased relative risks of injury, while those with careful/cautious behaviors had decreased risk. Paradoxically, children with attention and concentration problems (low self-regulation) also had decreased risk; a finding which implies behavior-related differential exposure to high-risk environments among children on farms and ranches. These results suggest that future research is needed on the procedures by which children are assigned certain chores on family agricultural operations; specifically, the role of behavioral and developmental differences in parents' decision-making about when particular children are ready to work, the chores they are ready to perform, and the levels of supervision they require.

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REFERENCES

Bijur PE, Stewart-Brown S, Butler N: Child behavior and accidental injury in 11,966 preschool children. *American Journal of Diseases of Children*, 140(5): 487-492, 1986.

Braun BL, Gerberich SG, Sidney S: Injury events: Utility of self-report in retrospective identification in the USA. *Journal of Epidemiology and Community Health*, 48(6): 604-605, 1994.

Breslow NE, Day NE. *Statistical methods in cancer research. Volume II - the design and analysis of cohort studies.* IARC Sci Publ. 1987;82:1-406.

Caspi A, Silva PA: Temperamental qualities at age three predict personality traits in young adulthood: Longitudinal evidence from a birth cohort. *Child Development*, 66(2): 486-498, 1995.

Cronbach LJ: Coefficient alpha and the internal structure of tests. *Psychometrika*, 16: 297-334, 1951.

Davidson LL: Hyperactivity, antisocial behavior, and childhood injury: A critical analysis of the literature. *Developmental and Behavioral Pediatrics*, 8(6): 335-340, 1987.

Davidson LL: Hyperactivity in school-age boys and subsequent risk of injury. *Pediatrics*, 90(5): 697-702, 1992.

Decisioneering: *Crystal Ball Users Manual 2000.2.* Denver, CO: Decisioneering, Inc., 1998.

DeRoo LA, Rautiainen RH: A systematic review of farm safety interventions. *American Journal of Preventive Medicine*, 18(4 Suppl): 51-62, 2000.

Elder GH Jr., Conger RD: *Children of the Land. Adversity and Success in Rural America.* Chicago, IL: University of Chicago Press, 2000.

Field A: *Discovering Statistics Using SPSS for Windows. Exploratory Factor Analysis.* London: Sage Publications, 2000.

Floyd FJ, Wideman KF: Factor analysis in the development and refinement of clinical assessment instruments. *Psychological Assessment*, 7: 286-289, 1995.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Fraser CE, Smith KB, Judd F, Humphreys JS, Fragar LJ, Henderson A: Farming and mental health problems and mental illness. *International Journal of Social Psychiatry*, 51(4): 340-349, 2005.

Friedman HS: Long-term relations of personality and health: Dynamisms, mechanisms, tropisms. *Journal of Personality*, 68(6): 1089, 2000.

Gerberich SG, Alexander BH, Church TR, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR: *Regional Rural Injury Study – II, Phase 2: Agricultural Injury Surveillance.* A report to the Centers for Disease Control and Prevention. Minneapolis: Regional Injury Prevention Center, University of Minnesota, 2004.

Gerberich SG, Gibson RW, French LD, Carr P, Renier CM, Gunderson P, Martin F, True J, Shutske J, Brademeyer K: *The Regional Rural Injury Study - I (RRIS-I): A population-based effort.* A Report to the Centers for Disease Control and Prevention. Minneapolis, Minnesota: Regional Injury Prevention Center, University of Minnesota, 1993.

Gerberich SG, Gibson RW, French LR, Church TR, Alexander BH, Shutske J, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR, Zhang X, Jensen KE: *Etiology and consequences of injuries among children in farm households: A regional rural injury study.* A report to the Centers for Disease Control and Prevention. Minneapolis: Regional Injury Prevention Center, University of Minnesota, 2003.

Gerberich SG, Gibson RW, French LR, Renier CM, Lee T-Y, Carr WP, Shutske J: Injuries among farm children and youth in farm households: Regional Rural Injury Study-I (RRIS-I). *Injury Prevention*, 7(2): 117-122, 2001.

Gerberich SG, Gibson RW, Gunderson PW, Melton LJ III, French LR, Renier CM, Erdman AG, True JA, Carr WP, Elkington JM: Validity of trauma reporting in the agricultural community. *Journal of Occupational Accidents*, 12: 200, 1990.

Greenland S, Pearl J, Robins JM: Causal diagrams for epidemiologic research. *Epidemiology*, 10(1): 37-48, 1999.

Hartling L, Brison RJ, Crumley ET, Klassen TP, Pickett W: A systematic review of interventions to prevent childhood farm injuries. *Pediatrics*, 114(4):e483-496, 2004.

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Hernán MA, Hernández-Díaz S, Werler MM, Mitchell AA: Causal knowledge as a prerequisite for confounding evaluation: An application to birth defects epidemiology. *American Journal of Epidemiology*, 155(2): 176-184, 2002.

Horvitz DG, Thompson DJ: A generalization of sampling without replacement from a finite universe. *Journal of the American Statistical Association*, 47(260): 663-685, 1952.

Ialongo NS, Kellam SG, Poduska,J: *Manual for the Parent Observation of Child Adaptation (Tech. Rep. No. 3)*. Baltimore, MD: Johns Hopkins University, 1999.

Jaquess DL, Finney JW: Previous injuries and behavior problems predict children's injuries. *Journal of Pediatric Psychology*, 19(1): 79-89, 1994.

Kelsey TW: The agrarian myth and policy responses to farm safety. *American Journal of Public Health*, 84(7): 1171-1177, 1994.

Keogh JP, Nuwayhid I, Gordon JL, Gucer PW: The impact of occupational injury on injured worker and family: outcomes of upper extremity cumulative trauma disorders in Maryland workers. *American Journal of Industrial Medicine*, 38(5): 498-506, 2000.

Kim J, Zepeda L: Factors affecting children's participation and amount of labor on family farms. *Journal of Safety Research*, 35(4): 391-401, 2004.

Langley J, McGee R, Silva P, Williams S: Child behavior and accidents. *Journal of Pediatric Psychology*, 8(2): 181-189, 1983.

Linn JG, Husaini BA: Determinants of psychological depression and coping behaviors of Tennessee farm residents. *Journal of Community Psychology*, 15(4): 503-512, 1987.

Lee BC, Jenkins LS, Westaby JD: Factors influencing exposure of children to major hazards on family farms. *Journal of Rural Health*, 13(3) 206-215, 1997.

Liang K-Y, Zeger SL: Longitudinal data analysis using generalized linear models. *Biometrika*, 73: 13-22, 1986.

Maclure M, Hankinson S: Analysis of selection bias in a case-control study of renal adenocarcinoma. *Epidemiology*, 1(6): 441-447, 1990.

Maldonado G: Adjusting a relative-risk estimate for study imperfections. Unpublished Manuscript, 2006.

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Manheimer DI, Mellinger GD: Personality characteristics of the child accident repeater. *Child Development*, 38(2): 491-513, 1967.

Mongin SJ: *Adjustment for non-response in the Minnesota Nurses Study.* Health Studies Research Report (http://www1.umn.edu/eoh/NewFiles/resreports.html). Division of Environmental Health Sciences, University of Minnesota, Minneapolis, 2001.

Morrongiello BA, House K: Measuring parent attributes and supervision behaviors relevant to child injury risk: Examining the usefulness of questionnaire measures. *Injury Prevention*, 10(2): 114-118, 2004.

National Safety Council: *Injury Facts, 2005-2006 Edition.* Itasca, IL: National Safety Council, 2006.

Peele PB, Tollerud DJ: Depression and occupational injury: Results of a pilot investigation. *Journal of Occupational and Environmental Medicine*, 47(4): 424-427, 2005.

Pickett W, Hartling L, Dimich-Ward H, Guernsey JR, Hagel L, Voaklander DC, Brison RJ: Surveillance of hospitalized farm injuries in Canada. *Injury Prevention*, 7(2): 123-128, 2001.

Rivara FP: Fatal and nonfatal farm injuries to children and adolescents in the United States, 1990-1993. *Injury Prevention*, 3(3): 190-194, 1997.

Rothman KJ, Greenland S: *Modern epidemiology*, Second Edition. Philadelphia: Lippincott-Raven, 1998.

Scarth R, Stallones L, Zwerling C, Burmeister L: The prevalence of depressive symptoms and risk factors among Iowa and Colorado farmers. *American Journal of Industrial Medicine*, 37(4): 382-389, 2000.

Schwebel DC, Plumert JM: Longitudinal and concurrent relations among temperament, ability estimation, and injury proneness. *Child Development*, 70(3): 700-712, 1999.

SPSS. *SPSS: Version 12.0 for Windows.* Chicago: Author, 2003.

Stallones L, Leff M, Garrett C, Criswell L, Gillan T: Depressive symptoms among Colorado farmers. *Journal of Agricultural Safety and Health*, 1(1): 37-43, 1995.

Steinberg L: Risk taking in adolescence: What changes, and why? *Annals of the New York Academy of Sciences*, 1021: 51-58, 2004.

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Vose D: *Risk Analysis. A Quantitative Guide (2nd Edition)*. New York, NY: John Wiley & Sons, LTD, 2000.

Wazana A: Are there injury-prone children? A critical review of the literature. *Canadian Journal of Psychiatry*, 42(6): 602-610, 1997.

Zuckerman M, Kuhlman DM: Personality and risk-taking: Common biosocial factors. *Journal of Personality*, 68(6): 999-1029, 2000.

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TABLE 1

Characteristics of Cases and Controls Six to <20 Years of Age: Regional Rural Injury Study – II (RRIS-II)

	Cases (n = 379)		Controls (n = 1,562)	
Characteristic	**n**	**(%)**	**n**	**(%)**
Gender				
Male	262	(69.1)	873	(55.9)
Female	117	(30.9)	689	(44.1)
Age (years)				
6 – <10	55	(14.5)	306	(19.6)
10 – <14	138	(36.4)	419	(26.8)
14 – <20	186	(49.1)	834	(53.4)
Missing/Unknown/Refused	0	(0.0)	3	(0.2)
Age- and Gender-Specific Percentile Body Mass Index				
<5th (Underweight)	19	(5.0)	75	(4.8)
5th – <85th (Normal weight)	235	(62.0)	958	(61.3)
85th – <95th (At Risk of Overweight)	70	(18.5)	239	(15.3)
95th + (Overweight)	45	(11.9)	242	(15.5)
Missing/Unknown/Refused	10	(2.6)	48	(3.1)
Hours Worked/Week on Operation				
<10	131	(34.6)	962	(61.6)
10 – <20	88	(23.2)	233	(14.9)
20 – <30	74	(19.5)	149	(9.5)
30 – <40	22	(5.8)	60	(3.8)
40 +	45	(11.9)	103	(6.6)
Missing/Unknown/Refused	19	(5.0)	55	(3.5)
Parents' Average Age				
<35 years	32	(8.4)	113	(7.2)

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35 – <45 years	234	(61.7)	786	(50.3)
45 – <55 years	101	(26.7)	581	(37.2)
55+ years	12	(3.2)	79	(5.1)
Missing/Unknown/Refused	0	(0.0)	3	(0.2)
Parents' Highest Education Level				
High school graduate, GED, or less	90	(23.8)	410	(26.3)
Some technical school or technical school graduate	52	(13.7)	239	(15.3)
Some college	88	(23.2)	376	(24.1)
College graduate or post-graduate	149	(39.3)	535	(34.3)
Missing/Unknown/Refused	0	(0.0)	2	(0.1)
Number of Children in Household				
1	61	(16.1)	472	(30.2)
2	137	(36.2)	546	(35.0)
3	101	(26.7)	346	(22.2)
4+	80	(21.1)	195	(12.5)
Missing/Unknown/Refused	0	(0.0)	3	(0.2)
Operation State				
Minnesota	49	(12.9)	299	(19.1)
Nebraska	91	(24.0)	345	(22.1)
North Dakota	72	(19.0)	282	(18.1)
South Dakota	93	(24.5)	369	(23.6)
Wisconsin	74	(19.5)	267	(17.1)
Type of Operation Requiring Most Time				
Beef cattle	110	(29.0)	422	(27.0)
Dairy cattle	81	(21.4)	201	(12.9)
Other animals	47	(12.4)	154	(9.9)
Field, forage, specialty crops; conservation reserve Program (CRP);	131	(34.6)	740	(47.4)

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or nothing during month of inquiry				
Missing/Unknown/Refused	10	(2.6)	45	(2.9)
Operation Income				
<15,000	45	(11.9)	138	(8.8)
15,000 – <30,000	99	(26.1)	413	(26.4)
30,000 – <50,000	118	(31.1)	482	(30.9)
50,000 +	79	(20.8)	331	(21.2)
Missing/Unknown/Refused	38	(10.0)	198	(12.7)

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TABLE 2

Risk of Agricultural Injury among Children Aged Six to <20 by Behavioral Items: Regional Rural Injury Study – II (RRIS-II)

	Cases n = 379		Controls n = 1,562		Multivariable Model†	
Behavioral Item	**n**	**(%)**	**n**	**(%)**	**OR***	**(95% CI)**
Acted Without Thinking						
Almost Always/Often	36	(9.7)	151	(9.9)	0.8	(0.5–1.3)
Almost Never/Sometimes	336	(90.3)	1372	(90.1)	Referent	
Was Impulsive						
Almost Always/Often	35	(9.4)	138	(9.1)	0.9	(0.5–1.5)
Almost Never/Sometimes	336	(90.6)	1383	(90.9)	Referent	
Liked to Plan Carefully						
Almost Never/Sometimes	165	(44.4)	580	(38.1)	1.3	(0.9–1.7)
Almost Always/Often	207	(55.6)	942	(61.9)	Referent	
Was Cautious						
Almost Never/Sometimes	88	(23.7)	289	(19.0)	1.6	(1.1–2.3)
Almost Always/Often	284	(76.3)	1235	(81.0)	Referent	

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Couldn't Sit Still					
Almost Always/Often	56	(15.1)	230	(15.1)	0.9 (0.6–1.3)
Almost Never/Sometimes	316	(84.9)	1293	(84.9)	Referent
Was Easily Distracted					
Almost Always/Often	37	(9.9)	151	(9.9)	0.9 (0.6–1.6)
Almost Never/Sometimes	335	(90.1)	1375	(90.1)	Referent
Paid Attention					
Almost Never/Sometimes	45	(12.1)	216	(14.2)	0.7 (0.4–1.1)
Almost Always/Often	327	(87.9)	1310	(85.8)	Referent
Had Good Concentration					
Almost Never/Sometimes	57	(15.4)	261	(17.1)	0.8 (0.5–1.3)
Almost Always/Often	314	(84.6)	1263	(82.9)	Referent
Followed Rules					
Almost Never/Sometimes	46	(12.4)	141	(9.2)	1.5 (0.9–2.5)
Almost Always/Often	326	(87.6)	1386	(90.8)	Referent
Broke Rules					
Almost Always/Often	13	(3.5)	32	(2.1)	2.0 (0.9–4.4)
Almost Never/Sometimes	359	(96.5)	1495	(97.9)	Referent
Left the Farm/House					
Almost Always/Often	14	(3.8)	27	(1.8)	1.4 (0.6–3.2)

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Almost Never/Sometimes	358	(96.2)	1482	(98.2)	Referent
Completed Work/Chores					
Almost Never/Sometimes	27	(7.3)	154	(10.1)	0.9 (0.5–1.6)
Almost Always/Often	342	(92.7)	1367	(89.9)	Referent
Worked Hard					
Almost Never/Sometimes	36	(9.7)	242	(15.9)	0.6 (0.3–0.9)
Almost Always/Often	336	(90.3)	1282	(84.1)	Referent
Got Into Fights					
Almost Always/Often	17	(4.6)	39	(2.6)	1.9 (0.9–3.8)
Almost Never/Sometimes	355	(95.4)	1482	(97.4)	Referent
Bullied Others					
Almost Always/Often	6	(1.6)	19	(1.2)	0.6 (0.2–2.2)
Almost Never/Sometimes	366	(98.4)	1506	(98.8)	Referent
Had Low Energy					
Almost Always/Often	14	(3.8)	38	(2.5)	1.7 (0.7–3.9)
Almost Never/Sometimes	357	(96.2)	1488	(97.5)	Referent
Looked Sad or Down					
Almost Always/Often	9	(2.4)	22	(1.4)	1.8 (0.7–5.1)
Almost Never/Sometimes	362	(97.6)	1502	(98.6)	Referent
Was Irritable					

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Almost Always/Often	24	(6.5)	86	(5.6)	0.9 (0.5–1.8)
Almost Never/Sometimes	348	(93.5)	1440	(94.4)	Referent

* Adjusted for within-household correlation using GEEs (Liang and Zeger, 1986) and weighted for non-response (Horvitz and Thompson, 1952; Mongin, 2001)

† Models included gender, age, body mass index, number of hours worked on operation, parents' average age, parents' highest education level, number of children in household, operation state, operation type, operation income, and 17 remaining behavioral items

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TABLE 3

Risk of Agricultural Injury among Children Aged Six to <20 by Behavioral Scales: Regional Rural Injury Study – II (RRIS-II)

	Cases n = 379		Controls n = 1,562		Multivariable Model†	
Behavioral Scale (items included)	**n**	**(%)**	**n**	**(%)**	**OR***	**(95% CI)**
Depressive Symptoms (looked sad or down; had low energy; was irritable)						
High	25	(6.7)	67	(4.4)	1.9	(1.0–3.7)
Medium	137	(36.8)	583	(38.2)	1.2	(0.9–1.5)
Low	210	(56.5)	876	(57.4)	Referent	
Aggression (broke rules; got into fights; was impulsive)						
High	30	(8.1)	84	(5.5)	1.6	(0.9–2.7)
Medium	125	(33.6)	486	(31.8)	1.0	(0.7–1.4)
Low	217	(58.3)	957	(62.7)	Referent	

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Self-Regulation (was easily distracted; had problems paying attention; had good concentration; worked hard)					
Low	34	(9.1)	167	(10.9)	0.4 (0.2–0.8)
Medium	133	(35.8)	591	(38.7)	0.7 (0.5–1.0)
High	205	(55.1)	769	(50.4)	Referent
Careful/Cautious (was careful; was cautious)					
Low	80	(21.5)	239	(15.7)	1.8 (1.1–2.9)
Medium	127	(34.1)	554	(36.3)	1.0 (0.7–1.4)
High	165	(44.4)	733	(48.0)	Referent
Responsible Conduct (completed work; followed rules)					
Low	34	(9.1)	135	(8.8)	1.2 (0.7–2.1)
Medium	123	(33.1)	448	(29.3)	1.2 (0.8–1.6)
High	215	(57.8)	944	(61.9)	Referent

* Adjusted for within-household correlation using GEEs (Liang and Zeger, 1986) and weighted for non-response (Horvitz and Thompson, 1952; Mongin, 2001)

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† Models included gender, age, body mass index, number of hours worked on operation, parents' average age, parents' highest education level, number of children in household, operation state, operation type, operation income, and four remaining behavioral scales

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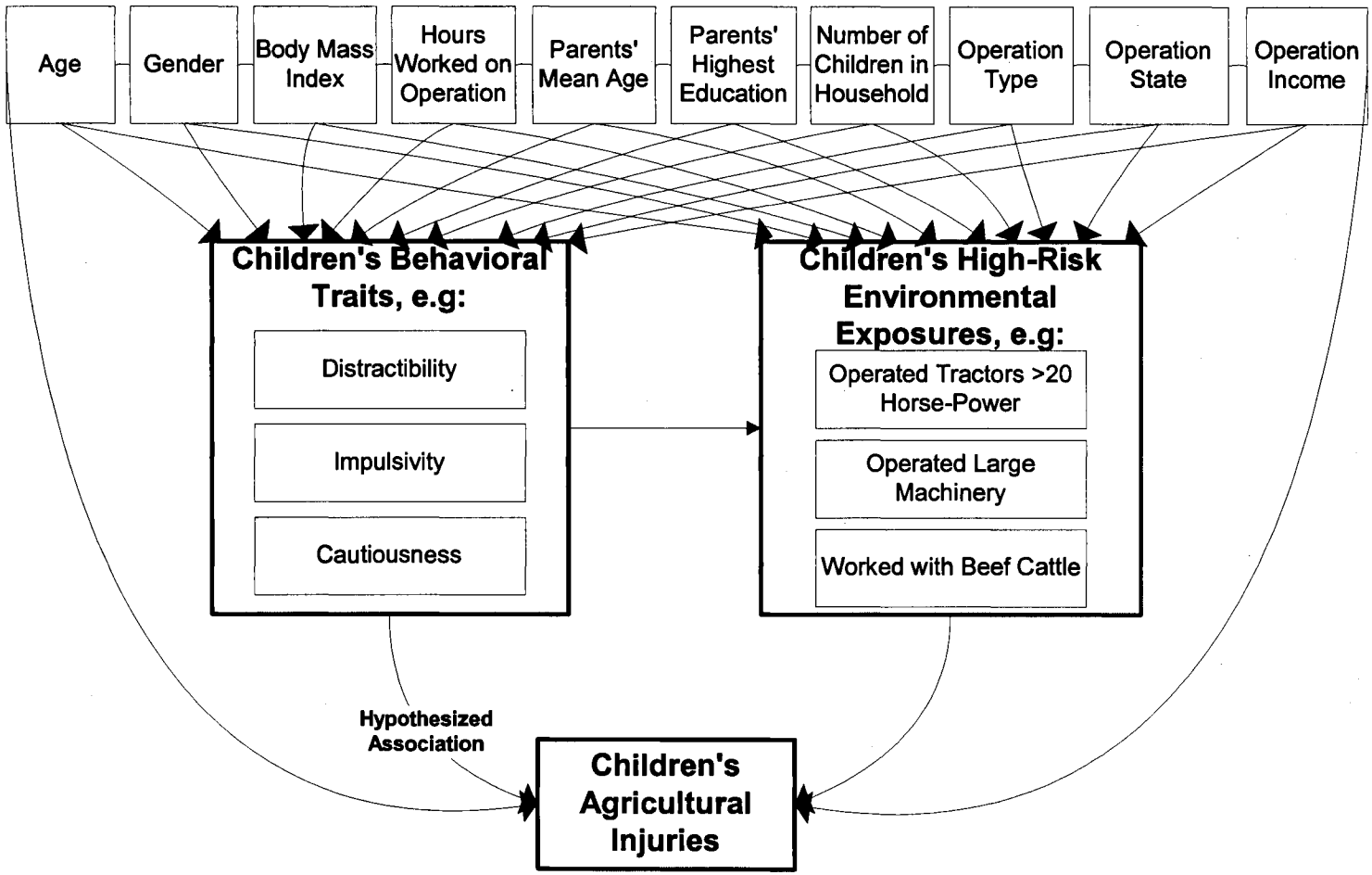
FIGURE 1: CAUSAL MODEL

Associations between Children's Behavioral Traits and Risk of Agricultural Injury:

Regional Rural Injury Study – II (RRIS-II)



ADDENDUM: UNCERTAINTY ANALYSES

Priors and Resulting Distributions of Select RR_{CAUSAL} Estimates: Regional Rural Injury Study – II (RRIS-II)

A. Priors: High vs. Low Depressive Symptoms and Children's Risk of Injury

Estimated Odds Ratio: 2.0

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.92; exposed controls = 0.84;

unexposed cases = 0.84; unexposed controls = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

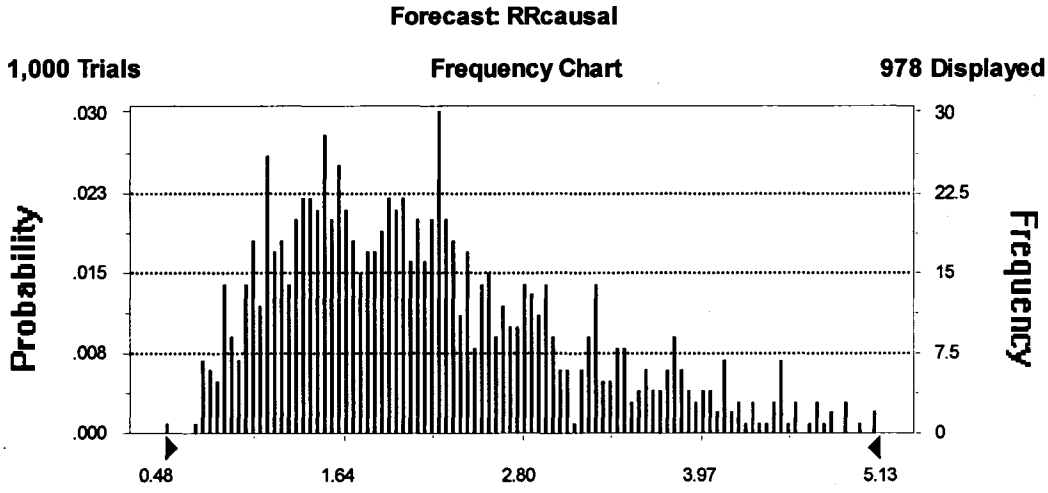
Missing Data: Triangular Distributions

cases: range = 0 – 7; likeliest value = 6

controls: range = 0 – 36; likeliest value = 22

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 2.3; Range = 0.5 – 7.5



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B. Priors: Low vs. High Self-Regulation and Children's Risk of Injury

Estimated Odds Ratio: 0.4

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.92; exposed controls = 0.84;

unexposed cases = 0.84; unexposed controls = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

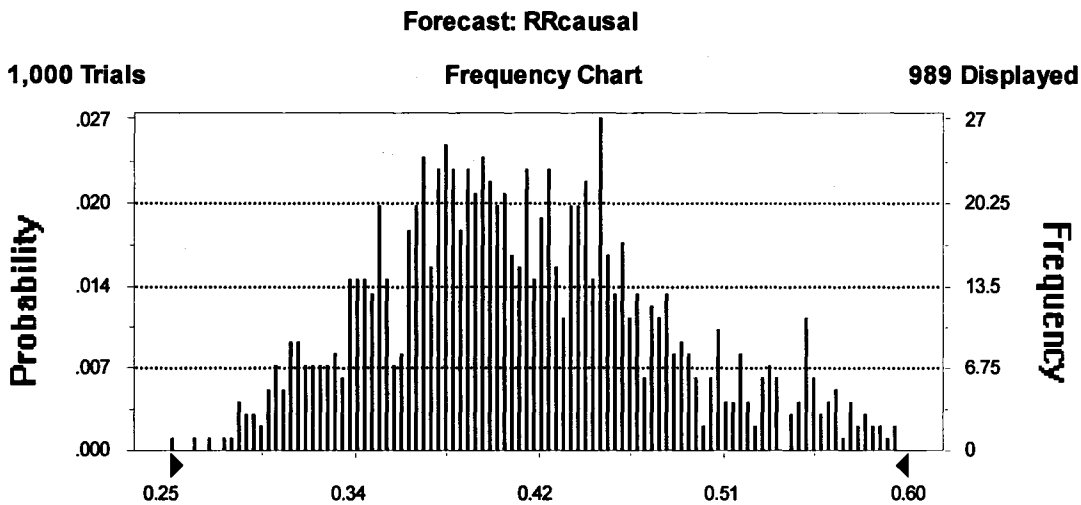
Missing Data: Triangular Distributions

cases: range = 0 – 7; likeliest value = 6

controls: range = 0 – 35; likeliest value = 21

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 0.4; Range = 0.3 – 0.6



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C. Priors: Low vs. High Careful/Cautious Behavior and Children's Risk of Injury

Estimated Odds Ratio: 1.9

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.86; exposed controls = 0.80;

unexposed cases = 0.88; unexposed controls = 0.82

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

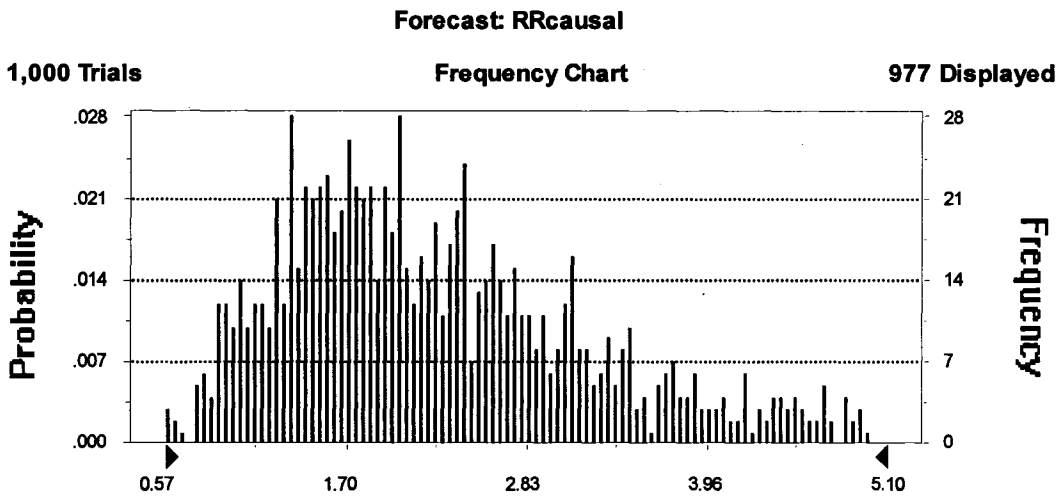
Missing Data: Triangular Distributions

cases: range = 0 – 7; likeliest value = 6

controls: range = 0 – 36; likeliest value = 22

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 2.3; Range = 0.5 – 7.3



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CHAPTER V

BEHAVIORAL FACTORS AND CHILDREN'S HIGH-RISK EXPOSURES

ABSTRACT

Children on family agricultural operations are at high risk of injury. Prior research has shown children's behavioral characteristics to be associated with their risk of agricultural injury. Whether behavior has a direct causal effect on children's risk, or is mediated through differential exposures, is unknown.

Data from the Regional Rural Injury Study–II, a population-based nested case-control study conducted in 1999 and 2001, were used to assess behavioral risk factors for high-risk exposures among children ages six to <20 years. Computer-assisted telephone interviews were used to collect demographic, behavior, and exposure data for six-month recall periods. A total of 1,941 children at-risk for agricultural injury were identified. Odds of high-risk work exposures were estimated in reference to behavioral items, adapted primarily from the Parent Observation of Child Adaptation (POCA) checklist, and scores for five scales, based on *a priori* constructs and exploratory factor analysis. Odds ratios (OR) and 95% confidence intervals (CI) were calculated through logistic regression, controlling for potential confounders selected using directed acyclic graphs.

Associations between children's behavioral items and scores, and their high-risk work exposures, were observed. For example, those with high, versus medium/low, scores for depressive symptoms were more likely to work with dairy cattle (OR=2.5, CI=1.3–4.7), while those with high aggression scores were more likely to ride on tractors (OR=1.8, CI=1.1–2.9) and operate large equipment (OR=1.7, CI=0.9–3.2). Children were less likely to operate tractors if they had low levels of self-regulation (OR=0.6, CI=0.4–1.0) or responsible conduct (OR=0.7, CI=0.4–1.1). Further, low levels of responsible conduct were associated with decreased work with beef cattle (OR=0.7, CI=0.4–1.0) and horses (OR=0.5, CI=0.3–0.8), and children with low levels of careful/cautious behavior were more likely to be frequent bystanders in fields or barnyards (OR=2.1, CI=1.2–3.8).

These and further results suggest that children's high-risk exposures are driven, in part, by their behavioral traits. This line of research may better inform educational interventions to prevent children's agricultural injury.

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BACKGROUND

Agriculture is among the most hazardous industries in the United States (US), with rates of fatal injuries nearly eight times greater than all other occupations combined (National Safety Council, 2006). Unlike other industrial settings, the proximity between family households and agricultural operations leads to unprecedented rates of pediatric mortality, morbidity, and disability in this population (Pickett et al., 2001; Rivara, 1997). Reasons for children's high risk of injury include their involvement in hazardous tasks and chores (Lee et al., 1997), as well as their bystanding in relevant work areas such as barns and fields (Mason and Earle-Richardson, 2002; Pickett et al., 2005).

Recent research has also identified children's behavioral traits as potential risk factors for agricultural injury (Carlson et al., 2006). This finding was consistent with results of prior studies examining children's behaviors and their risk of various types of injury (Bijur et al., 1986; Davidson, 1987; 1992; Jaquess and Finney, 1994; Schwebel and Plumert, 1999; Wazana, 1997). Evidence suggests this association may be due to increased levels of risk-taking among children with certain behavioral traits, such as hyperactivity or impulsivity (Ryb et al., 2006), as well as decreased parental supervision of children with behavior disorders (Schwebel et al., 2006).

Another potential mechanism for this association could be differential assignment of chores or tasks based on children's behaviors. Exposures to specific environmental hazards, such as tractors, machinery, and work with animals, are known to increase children's risk of injury on agricultural operations (Gerberich et al., 2001; Lee et al., 1996). While previous studies have identified sociocultural and economic determinants of children's work exposures on family operations (Kim and Zepeda, 2004a; 2004b; Lee et al., 1997), the role of children's behavioral traits in their assignment of chores has yet to be assessed.

Given the agricultural community's historical resistance to government regulation (Kelsey, 1994), safety-related interventions for this population rely primarily on educational initiatives (DeRoo and Rautiainen, 2000; Hartling et al., 2004). Improved knowledge of the association between children's behavioral characteristics and their high-risk work exposures on agricultural operations will clarify the causal pathways

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pertaining to children's agricultural injury, thus improving intervention efforts. This study examines the association between reported behaviors among children and their involvement in, or bystanding near, hazardous operation tasks.

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METHODS

Overview

This study was based on data from the Regional Rural Injury Study – II (RRIS–II), Phase 1 (1999) and Phase 2 (2001) efforts (Gerberich et al., 2003; 2004). The RRIS–II was a prospective, population-based study of injuries among agricultural household members in a five-state region of the US (Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin). A nested case-control study of agricultural injuries involving children, younger than 20 years of age (<20), was included. This study was approved by the University of Minnesota, Institutional Review Board, Human Subjects Committee.

Target Population

The US Department of Agriculture (USDA) National Agricultural Statistics Service Master ListFrame of Farming Operations provided the roster of farming and ranching operations. For each phase, random samples of 3,200 agricultural operations were selected from each of the five states, providing an n of 16,000 selected operations per year (total n = 32,000). Eligible operations had to have produced ≥$1,000 of agricultural goods during the year before the study and/or have land enrolled in a Conservation Reserve Program, and be actively engaged in farming/ranching as of January 1st. In addition, the operator's household had to be associated with the farm or ranch and include children <20 in residence as of January 1st.

The current analyses were based on data collected for the nested case-control studies. Cases were all agricultural injury events associated with their own operation and sustained during the reporting periods by children <20. The control population came from households randomly sampled to achieve a minimum ratio of three controls per case. To account for seasonal trends in injury incidence, injury rates from the most recent, similar study were used to estimate the number of controls needed: Phase 1 selection was based on data from the Regional Rural Injury Study – I (RRIS–I; Gerberich et al., 1993) while Phase 2 selection was based on Phase 1 data (Gerberich et al., 2003). An incidence-density sampling scheme was used to sample from the agricultural injury-free person-time experience (months) of children <20 in residence on the operation. One child with at

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least one agricultural injury-free month was randomly selected from each sampled household. The exposure experience was collected for the month before the month of injury for cases, and the month before an agricultural injury-free month for controls, sampled to reflect expected monthly incidence rates. This method allowed cases to be sampled as controls for months in which they did not sustain an agricultural injury.

Data Collection

Subsequent to introductory mailings, computer-assisted telephone interviews were conducted to obtain informed consent, establish eligibility, and enroll households. As an incentive to participate, all sampled operations were eligible for a drawing that provided at least a one in 32 probability of receiving a $100 US Savings Bond.

Participating households received packets containing study details and materials to facilitate collection of information during each of two full-length interviews. The interviews occurred in July of each study year, and January of the following year, and collected information on each six-month recall period of 1999 or 2001 (January–June; July–December). Non-respondents, for whom eligibility status was not established, were sent a one-page survey to ascertain eligibility of the household. Copies of the materials used, including interview instruments, are available on a website (Regional Injury Prevention Research Center, 2006).

The female head of household was the primary respondent for demographic and injury data, while the male head of household was preferred for operation exposure information. With parents' permission, children 12+ years were requested as their own respondents. The proxy for those who refused, and children <12, was the female head of household.

Independent Variables

For case and control children, ages six to <20 years (total n=1,941), responses were elicited for 18 behavioral items adapted from commonly used inventories; most were from the Parent Observation of Child Adaptation (POCA) checklist (Ialongo et al., 1999). Items included: [Child's name] almost never, sometimes, often, or almost always...completed work/chores; followed rules; worked hard; planned carefully before going ahead; was cautious; paid attention; had good concentration, acted without

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thinking; got into fights; was impulsive; broke rules; couldn't sit still; was easily distracted; was irritable; left the house or farm without permission; looked sad or down; bullied or was mean to others; and, had low energy.

These items were used to form behavioral scales relevant to the agricultural population. Hypothesized *a priori* constructs, based on POCA scales from which items were selected, were modified based on results of exploratory factor analysis (Field, 2000; Floyd and Wideman, 1995). Maximum likelihood analyses with promax oblique rotations were performed using SPSS version 12.0 for Windows (SPSS, 2003). Factors with eigenvalues greater than 1.0 and items with absolute values greater than 0.40 for factor loadings were retained for subsequent iterations. Cronbach's alphas were used as a test of internal consistency for resulting scales (Cronbach, 1951).

Five scales were developed using this approach: (1) Depression: Child looked sad or down; had low energy; was irritable (Cronbach's alpha = 0.58), (2) Aggression: Child broke rules; got into fights; was impulsive (alpha = 0.51), (3) Self-Regulation: Child was easily distracted; paid attention; had good concentration; worked hard (alpha = 0.78), (4) Careful/Cautious: Child was careful; was cautious (alpha = 0.58), and (5) Responsible Conduct: Child completed work; followed rules (alpha = 0.60).

Individual behavioral items were dichotomized to allow comparisons of children who almost always or often exhibited the behavior (almost always/often), versus those who almost never or sometimes did (almost never/sometimes). Item responses were reversed, where appropriate, for the five scalar constructs. Distributions were skewed and, thus, scores were categorized to compare children with the least desirable level of the behavior (to the extent possible, those within the 10^{th} percentile tail) to those with more moderate (10^{th} to $<50^{th}$ percentile) and desirable (50^{th} to 100^{th} percentile) scores. Depending on the direction of the scale, these categories are herein referenced as "high," "medium," and "low."

Dependent Variables

Based on results of initial risk factor research (Gerberich et al., 2003; 2004), children's work exposures defined as "high-risk" included: operating motor vehicles, tractors, and large equipment; riding on tractors; and, work with beef cattle, dairy cattle,

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and horses. Bystanding in agricultural work areas (fields or barnyards) was not identified as an injury risk factor in this data set; however, this item was also examined due to its relevance in other studies (Mason and Earle-Richardson, 2002; Pickett et al., 2005). Questions ascertaining exposure to high-risk work were posed in nominal (yes/no) format, while potential responses for the bystanding item were categorized as "frequently," versus "sometimes/never."

Data Analysis

Multivariable logistic regression was used to estimate children's risk of exposure to high-risk work while controlling for potentially confounding covariates (Breslow and Day, 1987). Odds ratios (OR) and 95% confidence intervals (CI) were calculated, using SAS *proc gendmod* (SAS, 2000), for children with the least desirable levels of each behavioral item or scale, in reference to those within more moderate/desirable scores.

Two models were analyzed: children's risk was first estimated while controlling for age and gender; the second model included age and gender, in addition to further potential confounders and the remaining behavioral items or scales. To identify potential confounders, a causal model (**Figure 1**) was used as a basis for the design and use of directed acyclic graphs (DAGs), following the methods described by Greenland et al. (1999) and illustrated by Hernán et al. (2002). The DAGs were also used to identify covariates that may introduce bias if included in the statistical models, and to reduce potential for over-fitting.

Odds ratios were adjusted for within-household correlation using generalized estimating equations (GEEs) (Liang and Zeger, 1986). Potential selection bias was controlled by inversely weighting observed responses with stratum-specific probabilities of response (Horvitz and Thompson, 1952), estimated as a function of characteristics available from the NASS database (state in which the operation was located, type of operation, and annual revenue by quintile). To account for unknown eligibility among non-respondents, probability of eligibility was estimated for these same characteristics and used to adjust weights (Mongin, 2001).

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Bias Evaluation

Probabilistic uncertainty analyses were conducted to estimate the likely magnitude and direction of bias due to potential study errors, including residual confounding, measurement error, selection bias (sampling bias, losses to follow-up, non-response, and missing data), and specification bias. Using methods similar to those of Vose (2000) and described by Maldonado (unpublished manuscript, 2006), the robustness of each model was assessed while simultaneously accounting for estimated biases from each of these sources.

Assuming no other issues of validity, estimated odds ratios from this study were the products of true odds ratios (i.e., effects of behavioral traits on children's high-risk environmental exposures), all bias factors, and random error. Using Crystal Ball Risk Analysis Software (Decisioneering, 1998), Monte Carlo simulations were used to forecast the product of the bias factors and, then, the distribution of probable true odds ratios for each independent variable. Priors were specified based on assumptions of the differential effects of the error sources on results for each analysis; priors are identified for select analyses in the study **Addendum**.

Briefly, values for residual confounding were centered at one but were allowed to vary by ten percent, assuming uniform distributions. Expecting recall bias to be the greatest source of measurement error; baseline mean values for correct recall were identified for each exposure, and allowed to vary for each cell in the respective 2x2 tables. Normal distributions with standard deviations equaling 10% of each value were also assumed. Sampling bias was calculated by centering mean values at one, assuming normal distributions with standard deviations of 0.10. For non-response, the average response proportion for each 2x2 table was set to equal 84.2% (the RRIS-II response rate) with slight variations across each cell. Distributions were assumed to be normal, had standard deviations equaling 10% of each value, and were truncated at 0 and one. Similar criteria were used to address non-response for "cases" and "non-cases" (those with and without high-risk environmental exposures). For missing data on behavioral traits, triangular distributions were used to forecast proportions of cases and non-cases likely to be exposed, with peak values set toward the maximum. Specification bias was considered

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by assigning normal distributions with mean values of one, but with standard deviations of 0.10, for each cell. Effects of random error were not considered in these analyses.

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RESULTS

Descriptive

Based on analyses (Gerberich et al., 2003; 2004), population data from each phase were comparable and, therefore, combined for the current study. A total of 8,810 (28%) of the farms/ranches were found to be eligible and, of those, 7,420 (84%) participated in the respective full study. Of the 1,941 children involved in the nested, case-control study, 379 sustained injury events (cases) while 1,562 provided exposure information for injury-free months (controls). The proportions of behaviors and exposures of interest among all 1,941 children were similar to proportions for controls only; thus, the entire sample was retained for analysis.

Demographic and Exposure Characteristics

Characteristics of the study population are presented in **Table 1**. More than half the population was male (59%) and between the ages of 14 and <20 (53%). More than one-fourth (29%) were 10 to <14 years and 19% were six to <10 years of age. Based on national age- and gender-specific body mass index profiles, 15% were considered overweight, 16% at risk of overweight, and 5% underweight. The majority (62%) were within normal range for BMI. Missing responses were identified for ≤4% of each covariate, with the exception of operation income (12%).

The most common type of enterprise was field, forage, or specialty crops (45%), while 27% were considered beef cattle operations, 15% dairy cattle, and 10% other animals. The majority of children (56%) were identified as having worked <10 hours per week on their agricultural operation; 8% worked forty hours or more. Large proportions of children: operated motor vehicles (42%), tractors (37%), and large equipment (26%); rode on tractors (34%); or, worked with beef cattle (36%). More modest percentages worked with dairy cattle (16%) or horses (19%). Frequent bystanding in fields or barnyards was reported for 10% of the population.

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Regression Analyses

Behavioral Items

Findings from the models, controlling for age and gender (data not shown), and the full multivariable models, identified both reduced and elevated risks of exposure among children with responses for undesirable behaviors (**Table 2**).

Reduced likelihood of exposure to machinery was identified for a number of behavioral items. For example, children who almost never/sometimes had good concentration (OR=0.8, CI=0.5–1.1) or almost always/often broke rules (OR=0.4, CI=0.2–1.0) were less likely to operate tractors, while those who almost never/sometimes completed work or chores (OR=0.6, CI=0.4–1.1) or worked hard (OR=0.7, CI=0.4–1.1) were less likely to operate large equipment. Further, children who almost never/sometimes completed work or chores had reduced risk of operating motor vehicles (OR=0.5, CI=0.3–0.9).

Pertinent to animal exposures, children were less likely to work with beef cattle if they almost always/often were either impulsive (OR=0.7, CI=0.4–1.1) or irritable (OR=0.5, CI=0.3–0.9), or if they almost never/sometimes were either cautious (OR=0.8, CI=0.6–1.1) or paid attention (OR=0.7, CI=0.5–1.0). Further, children who almost never/sometimes completed work or chores were less likely to work with dairy cattle (OR=0.2, CI=0.1–0.8).

While data are not shown, reduced risks of bystanding in fields or barnyards were identified for several items. Children, less likely to be frequent bystanders in these environments, were those who almost always/often were: impulsive (OR=0.6, CI=0.4–1.1); easily distracted (OR=0.5, CI=0.3–0.9); or irritable (OR=0.5, CI=0.3–0.8).

Increased odds of exposure to tractors and equipment were also identified for several items. Children who almost never/sometimes liked to plan carefully (OR=1.5, CI=1.1–2.0) or almost always/often got into fights (OR=2.9, CI=1.3–6.6) were more likely to operate tractors, while children who almost always/often were: easily distracted (OR=1.7, CI=1.1–2.6); got into fights (OR=2.0, CI=1.1–3.6); or had low energy (OR=1.7, CI=1.0–2.9) were at greater risk of riding on tractors. Children were at greater

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risk of operating large equipment if they almost always/often couldn't sit still (OR=1.7, CI=1.2–2.4).

Several items were also associated with increased exposure to animals. Children were more likely to work with beef cattle if they almost never/sometimes planned carefully (OR=1.4, CI=1.0–1.8) or almost always/often looked sad or down (OR=2.7, CI=1.2–6.1). Increased risks of work with dairy cattle were also identified for children who almost never/sometimes liked to plan carefully (OR=1.8, CI=1.1–3.0), as well as those who almost never/sometimes paid attention (OR=2.3, CI=1.1–5.2) or almost always/often were irritable (OR=2.7, CI=1.3–5.6).

Behavioral Scales

Behavioral scales were also associated with reduced and elevated odds of high-risk work (**Table 3**). Children were less likely to have operated tractors if they had low scores for self-regulation (OR=0.6, CI=0.4–1.0), while those with low scores for responsible conduct appeared less likely to have operated (OR=0.7, CI=0.4–1.1) or ridden on (OR=0.8, CI=0.5–1.1) tractors. Children with low scores for responsible conduct were also at reduced risk for work with beef cattle (OR=0.7, CI=0.4–1.0) or work with horses (data not shown: OR=0.5, CI=0.3–0.8).

Conversely, children were more likely to have ridden on tractors (OR=1.8, CI=1.1–2.9) or operated large equipment (OR=1.7, CI=0.9–3.2) if they had high scores for aggression. Those with high scores for depressive symptoms were more likely to have worked with dairy cattle (OR=2.5, CI=1.3–4.7), while those with low scores for careful/cautious behavior were more likely to be frequent bystanders in fields or barnyards (data not shown: OR=2.1, CI=1.2–3.8)

Uncertainty Analyses

The magnitude and direction of the effects of the behavioral items and scales on children's high-risk environmental exposures were largely unchanged when accounting for potential sources of study error. As identified in the **Addendum**, children with high versus medium/low levels of depressive symptoms had a mean odds ratio estimate of 3.5 for working with dairy cattle. Children with high versus medium/low aggression had a mean estimate of 2.2 for riding on tractors, while those with low levels of self-regulation

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had a mean estimate of 0.6 for operating tractors. However, while mean ORs tended to be farther from the null than the adjusted multivariable ORs, identified in the Results section, the distributions of possible ORs for most behavioral items and scales included the null value of 1.0. The ranges of possible ORs were 1.0–12.4 for depressive symptoms and work with dairy cattle, 0.6–6.8 for aggression and riding on tractors, and 0.1–2.0 for low self-regulation and operating tractors. Distribution charts for these examples are also identified (see **Addendum**).

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DISCUSSION

This study identified associations between children's behavioral characteristics and their high-risk work exposures. For example, children with high scores for depressive symptoms were more likely to work with dairy cattle, while those with high aggression scores were more likely to ride on tractors and operate large equipment. Children were less likely to operate tractors if they had low levels of self-regulation or responsible conduct. Further, low levels of responsible conduct were associated with decreased work with beef cattle and horses. Children with low levels of careful/cautious behavior were more likely to be frequent bystanders in fields or barnyards.

While previous research has found that children's development (Rivara and Howard, 1982; Zebrowitz et al., 1991) and behaviors (Deković et al., 1997; Schwebel et al., 2006) influence relevant parenting patterns, this study appears to be the first to identify associations between children's behaviors and their involvement in, or exposure to, high-risk work environments. Prior research, using the same data source as the current study, found that children with specific behavioral traits had greater risks of agricultural injury (Carlson et al., 2006). In light of the current findings, this increased risk may have been due, in part, to parents' differential assignment of chores to these children.

The current study found that children with certain behavioral traits were at greater risk of exposure to some work environments while, simultaneously, at reduced risk of exposure to other environments. For example, children who almost always/often were irritable or almost never/sometimes paid attention were less likely to have worked with beef cattle, while more likely to have worked with dairy cattle. Further, children who almost always/often were easily distracted were more likely to ride on tractors but less likely to be bystanders in fields or barnyards. It is known that parents take into consideration a large number of factors when assigning agriculture-related tasks or chores to their children (Kim and Zepeda, 2004b; Lee et al., 1997; Zebrowitz et al., 1991). It appears likely that parents also consider children's behavioral traits in determining readiness to perform chores. For irritable or inattentive children, parents may associate such behaviors with increased risk for work with beef cattle. For easily distractible children, parents may perceive less risk if the child is in close proximity as an extra rider

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on tractors. Whether these decisions are based on objective information or prior experience is unknown and should be explored further.

An interesting observation, overall, was that children with less desirable behaviors were exposed to dairy cattle more frequently than those with more moderate behavior levels. For example, children with high levels of depressive symptoms, those who almost never/sometimes liked to plan carefully or paid attention, and those who almost always/often were irritable, were identified as more likely to work with dairy cattle. Also, potentially high-risk children were more likely to be extra riders on tractors: those with high scores for aggression, and those who almost always/often were easily distracted, got into fights, or had low energy, had elevated odds ratios. These findings imply that parents differentially assign work with dairy cattle, or riding on tractors, to children with potentially high-risk behaviors; an important consideration given that both exposures are known to increase children's risk of injury (Gerberich et al., 2001; Hendricks et al., 2004).

It may be that parents consider the severity of potential injuries when differentially assigning chores or exposures to children. Of the work exposures examined, children with undesirable behaviors were more often at reduced risk of working with tractors or equipment: children with low levels of self-regulation or responsible conduct were less likely to have operated tractors, as were children who almost never/sometimes had good concentration or almost always/often broke rules, while children who almost never/sometimes completed work/chores or worked hard were less likely to have operated large equipment. While animals are frequent sources of nonfatal injury among children, tractor- or equipment-related injuries tend to have grave consequences, including severely disabling and fatal injuries (Pickett et al., 1999). Given that farm and ranch families believe children's participation in work to be important for their social development (Kim and Zepeda, 2004a), it is feasible that parents balance children's risks by conscientiously assigning chores with potentially less severe consequences to higher-risk children.

Regardless of the causal rationale for these findings, this study has implications for future educational efforts targeted to farm and ranch family households. Previous

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research on children's agricultural injury has examined parental knowledge of child development (Pickett et al., 2003), parental supervision (Pryor et al., 2002), and children's age-related maturity (Mason and Earle-Richardson, 2002), as potential risk-mediating variables. Along with children's cognitive and physical capabilities, these factors were comprehensively taken into account in the recommendations of the North American Guidelines for Children's Agricultural Tasks (NAGCAT) (Lee and Marlenga, 1999). However, evaluative efforts have shown that parents often assign age-inappropriate tasks to their children (Pickett et al., 2003), despite relatively thorough understanding of child development (Mason and Earle-Richardson, 2002). Results of the current study indicate that parents recognize and respond to children's potential high-risk behaviors. Future educational interventions might consider parental assessment of children's behaviors in determining age- and developmental-appropriateness for high-risk work exposure.

Strengths and Limitations

Given the observational nature of these data, results should be interpreted in light of potential limitations. While the multivariable analyses controlled for a number of potential confounders, including type of enterprise, operation income, children's hours worked, parents' education levels, and number of children in the household, the potential for an additional, unmeasured confounder cannot be ruled out. For example, parenting factors, such as supervision, could explain some children's behaviors and also affect their risk of injury (Morrongiello et al., 2006). Further, data on children's behaviors and exposures may have been susceptible to recall bias as these were assessed simultaneously for each six-month reporting period. However, many steps were implemented during the data collection and analysis phases in order to limit these potential biases. For example, use of the six-month recall period for collection of exposure data, and restriction of the etiologic time period to the month, prior to the event for cases, or a randomly-selected month for controls, were expected to have reduced the potential for recall bias or misclassification. Additionally, statistical adjustments for within-household correlation and non-response were made to further limit selection biases.

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Efforts were also made to quantitatively assess the impact of potential remaining biases on study results. However, while probabilistic uncertainty analyses indicated the magnitude and direction of most odds ratios to be largely unchanged in light of recall bias (in addition to other sources of error), there were limited data on which the specified priors could be based. Future studies that provide quantitative measurements of recall bias and other error factors, through validation studies or otherwise, would contribute substantially to this area of inquiry.

Finally, given that a main intent of the RRIS–II was to serve as a surveillance effort not only for the incidence and consequences of all types of injury but, also, for environmental risk factors for agricultural injury, the behavioral items measured were limited in scope and number. The 18 items were selected for inclusion, based on their deemed relevance to work and safety on agricultural operations. The *a priori* constructs, based mostly on the questionnaires from which the items were adapted, were informed by exploratory factor analyses to yield the scales that were used; however, measures of internal consistency for most scales were relatively low. Low Cronbach's alphas may have been a result of the low number of items, included in each scale, but might also indicate limited interpretability for the factors used.

Conclusions

This study is the first to explore behavior-based differential assignment of chores to children in agricultural households. While associations between children's behaviors and their risk of injury have been observed, there is limited understanding of the causal nature of this association. The current results imply that children's high-risk exposures are driven, at least in part, by their behavioral characteristics. Further research should explore parents' perception of the relative risks of farm tasks commonly assigned to children as a potential determinant of behavior-based work exposures. This line of research may better inform educational interventions to prevent children's agricultural injury.

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REFERENCES

Bijur PE, Stewart-Brown S, Butler N: Child behavior and accidental injury in 11,966 preschool children. *American Journal of Diseases of Children*, 140(5): 487-492, 1986.

Breslow NE, Day NE. *Statistical methods in cancer research. Volume II - the design and analysis of cohort studies.* IARC Sci Publ. 1987;82:1-406.

Carlson KF, Gerberich SG, Alexander BH, Masten AS, Church TR, Ryan AD, Renier CM: *Children's Agricultural Injury: Potential Behavior-Related Risk Factors*, Congress of Epidemiology, Seattle, Washington, June 2006.

Cronbach LJ: Coefficient alpha and the internal structure of tests. *Psychometrika*, 16: 297-334, 1951.

Davidson LL: Hyperactivity, antisocial behavior, and childhood injury: A critical analysis of the literature. *Developmental and Behavioral Pediatrics*, 8(6): 335-340, 1987.

Davidson LL: Hyperactivity in school-age boys and subsequent risk of injury. *Pediatrics*, 90(5): 697-702, 1992.

Decisioneering: *Crystal Ball Users Manual 2000.2.* Denver, CO: Decisioneering, Inc., 1998.

Deković M, Noom MJ, Meeus W: Expectations regarding development during adolescence: Parental and Adolescent Perceptions. *Journal of Youth and Adolescence*, 26(3): 1997.

DeRoo LA, Rautiainen RH: A systematic review of farm safety interventions. *American Journal of Preventive Medicine*, 18(4 Suppl): 51-62, 2004.

Field A: *Discovering Statistics Using SPSS for Windows. Exploratory Factor Analysis.* London: Sage Publications, 2000.

Floyd FJ, Wideman KF: Factor analysis in the development and refinement of clinical assessment instruments. *Psychological Assessment*, 7: 286-289, 1995.

Gerberich SG, Alexander BH, Church TR, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR: *Regional Rural Injury Study – II, Phase 2: Agricultural Injury Surveillance.* A report to the Centers for Disease Control and Prevention. Minneapolis: Regional Injury Prevention Center, University of Minnesota, 2004.

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Gerberich SG, Gibson RW, French LR, Church TR, Alexander BH, Shutske J, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR, Zhang X, Jensen KE: *Etiology and consequences of injuries among children in farm households: A regional rural injury study.* A report to the Centers for Disease Control and Prevention. Minneapolis: Regional Injury Prevention Center, University of Minnesota, 2003.

Gerberich SG, Gibson RW, French LR, Renier CM, Lee T-Y, Carr WP, Shutske J: Injuries among farm children and youth in farm households: Regional Rural Injury Study-I (RRIS-I). *Injury Prevention*, 7(2): 117-122, 2001.

Greenland S, Pearl J, Robins JM: Causal diagrams for epidemiologic research. *Epidemiology*, 10(1): 37-48, 1999.

Hartling L, Brison RJ, Crumley ET, Klassen TP, Pickett W: A systematic review of interventions to prevent childhood farm injuries. *Pediatrics*, 114(4): e483-496, 2004.

Hendricks KJ, Goldcamp EM, Myers JR: On-farm falls among youth less than 20 years old in the U.S. *Journal of Agricultural Safety and Health*, 10(1): 27-38, 2004.

Hernán MA, Hernández-Díaz S, Werler MM, Mitchell AA: Causal knowledge as a prerequisite for confounding evaluation: An application to birth defects epidemiology. *American Journal of Epidemiology*, 155(2): 176-184, 2002.

Horvitz DG, Thompson DJ: A generalization of sampling without replacement from a finite universe. *Journal of the American Statistical Association*, 47(260): 663-685, 1952.

Ialongo NS, Kellam SG, Poduska,J: *Manual for the Parent Observation of Child Adaptation (Tech. Rep. No. 3).* Baltimore, MD: Johns Hopkins University, 1999.

Jaquess DL, Finney JW: Previous injuries and behavior problems predict children's injuries. *Journal of Pediatric Psychology*, 19(1): 79-89, 1994.

Kim J, Zepeda L: Time allocation by fathers, mothers and children in U.S. family farm households: A bargaining approach. Feminist Economics, 10(1): 115-139, 2004a.

Kim J, Zepeda L: Factors affecting children's participation and amount of labor on family farms. *Journal of Safety Research*, 35(4): 391-401, 2004b.

Lee BC, Jenkins LS, Westaby JD: Factors influencing exposure of children to major hazards on family farms. *Journal of Rural Health*, 13(3) 206-215, 1997.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Lee BC, Marlenga B, eds: *Professional Resource Manual: North American Guidelines for Children's Agricultural Tasks*. Marshfield, WI: Marshfield Clinic, 1999.

Lee T-Y, Gerberich SG, Gibson RW, Carr WP, Shutske J, Renier CM: A population-based study of tractor-related injuries: Regional Rural Injury Study – I (RRIS-I). *Journal of Occupational and Environmental Medicine*, 38(8): 782-793, 1996.

Liang K-Y, Zeger SL: Longitudinal data analysis using generalized linear models. *Biometrika*, 73: 13-22, 1986.

Maldonado G: Adjusting a relative-risk estimate for study imperfections. Unpublished Manuscript, 2006.

Mason C, Earle-Richardson G: New York state child agricultural injuries: How often is maturity a potential contributing factor? *American Journal of Industrial Medicine Supplement*, 2: 36-42, 2002.

Mongin SJ: *Adjustment for non-response in the Minnesota Nurses Study.* Health Studies Research Report (http://www1.umn.edu/eoh/NewFiles/resreports.html). Division of Environmental Health Sciences, University of Minnesota, Minneapolis, 2001.

Morrongiello BA, Corbett M, McCourt M, Johnston N: Understanding Unintentional Injury Risk in Young Children II. The Contribution of Caregiver Supervision, Child Attributes, and Parent Attributes. *Journal of Pediatric Psychology*, 31(6): 540-551, 2006.

National Safety Council: *Injury Facts, 2005-2006 Edition*. Itasca, IL: National Safety Council, 2006.

Pickett W, Brison RJ, Berg, RL, Zentner J, Linneman, J, Marlenga B: Pediatric farm injuries involving non-working children injured by a farm work hazard: five priorities for primary prevention. *Injury Prevention*, 11: 6-11, 2005.

Pickett W, Hartling L, Brison RJ, Guernsey JR: Fatal work-related farm injuries in Canada, 1991-1995. Canadian Agricultural Injury Surveillance Program. *Canadian Medical Association Journal*, 160: 1843-1848, 1999.

Pickett W, Hartling L, Dimich-Ward H, Guernsey JR, Hagel L, Voaklander DC, Brison RJ: Surveillance of hospitalized farm injuries in Canada. *Injury Prevention*, 7:123-128, 2001.

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Pickett W, Marlenga B, Berg RL: Parental knowledge of child development and the assignment of tractor work to children. *Pediatrics*, 112(1 Pt 1): e11-e16, 2003.

Pryor SK, Caruth AK, McCoy CA: Children's injuries in agriculture related events: The effect of supervision on the injury experience. *Issues in Comprehensive Pediatric Nursing*, 25(3): 189-205, 2002.

Regional Injury Prevention Research Center (RIPRC). Division of Environmental Health Sciences, School of Public Health, University of Minnesota, Minneapolis. Available at http://enhs.umn.edu/riprc.html. Accessed June 15, 2006.

Rivara FP: Fatal and nonfatal farm injuries to children and adolescents in the United States, 1990-1993. *Injury Prevention*, 3(3): 190-194, 1997.

Rivara FP, Howard D: Parental knowledge of child development and injury risks. *Developmental and Behavioral Pediatrics*, 3(2): 103-105, 1982.

Ryb GE, Dischinger PC, Kufera J, Read KM: Risk perception and impulsivity: Association with risky behaviors and substance abuse disorders. *Accident Analysis and Prevention*, 38(3): 567-573, 2006.

SAS. *SAS OnlineDoc[R], Version 8.* SAS Institute, Inc, 2000.

Schwebel DC, Hodgens JB, Sterling S: How mothers parent their children with behavior disorders: Implications for unintentional injury risk. *Journal of Safety Research*, 37: 167-173, 2006.

Schwebel DC, Plumert JM: Longitudinal and concurrent relations among temperament, ability estimation, and injury proneness. *Child Development.* 70(3): 700-712, 1999.

SPSS. *SPSS: Version 12.0 for Windows*. Chicago: Author, 2003.

Vose D: *Risk Analysis. A Quantitative Guide (2nd Edition)*. New York, NY: John Wiley & Sons, LTD, 2000.

Wazana A: Are there injury-prone children? A critical review of the literature. *Canadian Journal of Psychiatry*, 42(6): 602-610, 1997.

Zebrowitz LA, Kendall-Tackett K, Fafel J: The influence of children's facial maturity on parental expectations and punishments. *Journal of Experimental Child Psychology*, 52(2): 221-238, 1991.

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TABLE 1

Demographic and Exposure Characteristics of Participants Six to <20 Years of Age: Regional Rural Injury Study – II (RRIS-II)

Characteristic	n	(%)
Gender		
Male	1,135	(58.5)
Female	806	(41.5)
Age (years)		
6 – <10	361	(18.6)
10 – <14	557	(28.7)
14 – <20	1,020	(52.6)
Missing/Unknown/Refused	3	(0.2)
Age- and Gender-Specific Percentile Body Mass Index		
<5th (Underweight)	94	(4.8)
5th – <85th (Normal weight)	1,193	(61.5)
85th – <95th (At Risk of Overweight)	309	(15.9)
95th + (Overweight)	287	(14.8)
Missing/Unknown/Refused	58	(3.0)
Operation Income During Year Prior to Study		
<15,000	183	(9.4)
15,000 – <30,000	512	(26.4)
30,000 – <50,000	600	(30.9)
50,000 +	410	(21.1)
Missing/Unknown/Refused	236	(12.2)
Type of Operation Requiring Most Work Time		
Beef cattle	532	(27.4)
Dairy cattle	282	(14.5)
Other animals	201	(10.4)
Field, forage, specialty crops; conservation reserve Program (CRP); or nothing during month of inquiry	871	(44.9)

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Missing/Unknown/Refused	55	(2.8)
Hours Worked/Week on Agricultural Operation		
<10	1,093	(56.3)
10 – <20	321	(16.5)
20 – <30	223	(11.5)
30 – <40	82	(4.2)
40 +	148	(7.6)
Missing/Unknown/Refused	74	(3.8)

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TABLE 2

Odds Ratios and 95% Confidence Intervals* for High-Risk Exposures among Children Ages Six to <20 by Behavioral Items: Regional Rural Injury Study – II (RRIS-II)

	Operated Vehicles		Operated Tractors		Rode on Tractors		Operated Lg. Equipment		Worked with Beef Cattle		Worked with Dairy Cattle	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Behavioral Item	n=810	1,059	n=708	1,161	n=725	1,120	n=498	1,366	n=692	1,180	n=300	1,573
Acted Without Thinking	%		%		%		%		%		%	
Almost Always/Often	35.3	63.1	36.7	62.0	44.9	51.9	24.6	73.3	30.5	67.9	21.9	76.5
Almost Never/Sometimes†	43.5	54.0	37.4	60.1	37.3	59.3	26.5	71.0	36.9	60.7	15.2	82.5
Multivariable Model‡	0.8	(0.5–1.3)	1.1	(0.7–1.8)	1.4	(0.9–2.1)	1.0	(0.6–1.6)	0.8	(0.5–1.2)	1.1	(0.4–2.9)
Was Impulsive												
Almost Always/Often	36.4	61.9	34.1	64.2	47.4	50.3	24.9	73.4	30.1	68.2	16.8	81.5
Almost Never/Sometimes†	43.2	54.3	37.5	60.0	37.1	59.4	26.2	71.2	36.9	60.7	15.7	82.0
Multivariable Model‡	0.8	(0.5–1.4)	0.9	(0.5–1.6)	1.1	(0.7–1.6)	0.9	(0.5–1.5)	0.7	(0.4–1.1)	0.7	(0.3–1.6)
Liked to Plan Carefully												
Almost Never/Sometimes	37.3	60.5	35.3	62.3	39.2	57.1	25.0	72.8	36.8	61.1	18.3	79.6
Almost Always/Often†	46.2	51.3	38.6	58.9	37.4	59.4	27.2	70.2	36.1	61.4	14.3	83.4
Multivariable Model‡	1.0	(0.7–1.4)	1.5	(1.1–2.0)	1.0	(0.8–1.3)	1.4	(1.0–1.9)	1.4	(1.0–1.8)	1.8	(1.1–3.0)

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Was Cautious										
Almost Never/Sometimes	34.2	64.2	29.7	69.0	37.7	59.7	21.5	76.9	35.8	62.6	17.0	81.4
Almost Always/Often†	44.8	52.7	39.2	58.1	38.2	58.2	27.5	69.5	36.5	61.0	15.5	82.0
Multivariable Model‡	0.9	(0.6–1.3)	0.9	(0.6–1.3)	0.9	(0.7–1.2)	0.9	(0.6–1.4)	0.8	(0.6–1.1)	0.8	(0.5–1.4)
Couldn't Sit Still										
Almost Always/Often	42.0	55.6	36.4	61.2	43.0	54.2	31.5	66.1	37.8	59.8	16.1	81.5
Almost Never/Sometimes†	42.7	54.9	37.5	60.1	37.2	59.3	25.3	72.2	36.0	61.7	15.8	82.0
Multivariable Model‡	1.2	(0.8–1.7)	0.9	(0.6–1.4)	1.1	(0.8–1.4)	1.7	(1.2–2.4)	1.2	(0.8–1.6)	1.0	(0.6–1.9)
Was Easily Distracted										
Almost Always/Often	31.4	66.0	29.8	68.1	46.3	51.1	22.9	75.0	35.1	62.8	16.0	81.9
Almost Never/Sometimes†	43.9	53.8	38.1	59.5	37.1	59.4	26.6	70.9	36.4	61.2	15.8	81.9
Multivariable Model‡	0.9	(0.5–1.5)	1.0	(0.6–1.7)	1.7	(1.1–2.6)	1.0	(0.6–1.6)	1.4	(0.9–2.4)	1.3	(0.6–2.5)
Paid Attention										
Almost Never/Sometimes	35.3	62.1	28.4	68.2	36.0	59.8	21.1	76.3	31.0	66.3	17.6	79.7
Almost Always/Often†	43.8	53.9	38.7	59.1	38.4	58.3	27.1	70.5	37.1	60.6	15.5	82.3
Multivariable Model‡	1.0	(0.6–1.5)	0.9	(0.5–1.5)	0.9	(0.6–1.3)	0.8	(0.5–1.3)	0.7	(0.5–1.0)	2.3	(1.1–5.2)
Had Good Concentration										
Almost Never/Sometimes	38.4	59.4	32.4	65.1	39.9	56.9	23.3	74.5	37.4	60.4	15.1	82.7
Almost Always/Often†	43.6	54.0	38.3	59.3	37.7	58.8	26.9	70.6	36.1	61.5	15.9	81.8
Multivariable Model‡	1.0	(0.7–1.5)	0.8	(0.5–1.1)	0.9	(0.7–1.3)	0.9	(0.6–1.3)	1.0	(0.7–1.5)	0.9	(0.5–1.6)

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Followed Rules										
Almost Never/Sometimes	35.8	60.4	26.2	70.6	36.4	59.4	21.9	74.3	30.0	66.3	17.1	79.1
Almost Always/Often[†]	43.3	54.4	38.4	59.2	38.2	58.5	26.7	71.0	37.0	60.9	15.7	82.2
Multivariable Model[‡]	1.5	(0.9–2.4)	0.8	(0.5–1.3)	1.0	(0.7–1.5)	1.2	(0.7–2.0)	0.9	(0.6–1.5)	1.4	(0.7–2.8)
Broke Rules										
Almost Always/Often	44.4	51.1	28.9	66.7	40.0	55.6	31.1	64.4	31.1	64.4	24.4	71.1
Almost Never/Sometimes[†]	42.6	55.1	37.4	60.2	38.0	58.6	26.1	71.5	36.4	61.3	15.6	82.2
Multivariable Model[‡]	0.9	(0.3–2.8)	0.4	(0.2–1.0)	0.9	(0.4–2.0)	1.0	(0.4–2.3)	1.4	(0.5–3.2)	1.9	(0.4–9.8)
Left the Farm/House										
Almost Always/Often	63.4	36.6	43.9	56.1	29.3	68.3	31.7	68.3	31.7	68.3	19.5	80.5
Almost Never/Sometimes[†]	41.1	55.5	37.1	60.4	38.5	58.1	26.1	71.5	36.6	61.1	15.8	82.0
Multivariable Model[‡]	1.0	(0.4–2.6)	0.4	(0.2–1.0)	0.5	(0.3–1.1)	0.5	(0.2–1.2)	0.5	(0.2–1.2)	1.1	(0.4–2.9)
Completed Work/Chores										
Almost Never/Sometimes	26.5	71.8	22.7	75.7	32.0	64.6	16.0	82.3	28.2	70.2	7.7	90.6
Almost Always/Often[†]	44.5	53.1	38.9	58.6	38.7	57.8	27.4	70.0	37.3	60.3	16.7	80.9
Multivariable Model[‡]	0.5	(0.3–0.9)	0.7	(0.4–1.1)	0.7	(0.5–1.1)	0.6	(0.4–1.1)	0.8	(0.5–1.2)	0.2	(0.1–0.8)
Worked Hard										
Almost Never/Sometimes	45.1	52.7	40.2	57.5	38.8	58.0	27.7	69.9	37.5	60.3	16.8	81.1
Almost Always/Often[†]	28.8	68.4	20.5	76.3	34.2	61.5	18.0	79.1	29.9	67.3	10.4	86.7
Multivariable Model[‡]	0.8	(0.5–1.2)	1.3	(0.8–2.1)	1.1	(0.8–1.6)	0.7	(0.4–1.1)	1.5	(1.0–2.3)	1.1	(0.5–2.3)

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Got Into Fights										
Almost Always/Often	66.1	33.9	35.7	64.3	55.4	44.6	17.9	82.1	41.1	58.9	14.3	85.7
Almost Never/Sometimes†	42.9	54.7	37.3	60.3	37.5	59.0	26.5	71.0	36.3	61.4	15.8	81.9
Multivariable Model‡	2.0	(0.9–4.4)	2.9	(1.3–6.6)	2.0	(1.1–3.6)	1.0	(0.4–2.8)	1.7	(0.8–3.4)	0.3	(0.1–1.4)
Bullied Others										
Almost Always/Often	32.0	64.0	28.0	68.0	32.0	64.0	16.0	80.0	20.0	76.0	20.0	76.0
Almost Never/Sometimes†	42.7	54.9	37.4	60.2	38.1	58.5	26.4	71.2	36.5	61.2	15.7	82.1
Multivariable Model‡	0.7	(0.2–3.0)	0.7	(0.3–2.1)	0.6	(0.2–1.6)	0.7	(0.2–2.6)	0.7	(0.2–3.2)	0.4	(0.1–1.7)
Had Low Energy										
Almost Always/Often	30.8	67.3	32.7	65.4	44.2	51.9	21.2	76.9	36.5	61.5	17.3	80.8
Almost Never/Sometimes†	43.0	54.6	37.4	60.2	37.9	58.7	26.4	71.1	36.3	61.4	15.8	82.0
Multivariable Model‡	0.6	(0.3–1.4)	1.0	(0.4–2.4)	1.7	(1.0–2.9)	1.0	(0.4–2.3)	1.3	(0.6–2.6)	0.9	(0.1–7.4)
Looked Sad or Down										
Almost Always/Often	51.6	48.4	48.4	51.6	45.2	54.8	32.3	67.6	51.6	48.4	22.6	77.4
Almost Never/Sometimes†	42.5	55.1	37.1	60.5	38.0	58.6	26.2	71.4	36.1	61.6	15.7	82.0
Multivariable Model‡	1.9	(0.8–4.8)	2.3	(0.9–6.0)	1.0	(0.5–2.0)	1.5	(0.6–3.9)	2.7	(1.2–6.1)	2.4	(0.6–9.4)
Was Irritable										
Almost Always/Often	43.6	56.4	35.5	64.6	38.2	61.8	24.6	75.5	31.8	68.2	20.9	79.1
Almost Never/Sometimes†	42.6	54.9	37.4	60.1	38.0	58.3	26.3	71.0	36.6	61.0	15.5	82.1
Multivariable Model‡	1.2	(0.6–2.2)	1.0	(0.6–1.9)	1.1	(0.6–1.8)	1.2	(0.7–2.0)	0.5	(0.3–0.9)	2.7	(1.3–5.6)

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* Adjusted for within-household correlation using GEEs (Liang and Zeger, 1986) and weighted for non-response (Horvitz and Thompson, 1952; Mongin, 2001)

† Referent category

‡ Models included gender, age, body mass index, number of hours worked on operation, parents' average age, parents' highest education level, number of children in household, operation state, operation type, operation income, and 17 remaining behavioral items

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TABLE 3

Odds Ratios and 95% Confidence Intervals* for High-Risk Exposures among Children Ages Six to <20 by Behavioral Scales: Regional Rural Injury Study – II (RRIS-II)

	Operated Vehicles		Operated Tractors		Rode on Tractors		Operated Lg. Equipment		Worked with Beef Cattle		Worked with Dairy Cattle	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Behavioral Scale	n=810	1,059	n=708	1,161	n=725	1,120	n=498	1,366	n=692	1,180	n=300	1,573
Depressive Symptoms	%		%		%		%		%		%	
High	43.5	55.4	37.0	62.0	41.3	56.5	25.0	73.9	38.0	60.9	22.8	76.1
Medium/Low†	42.6	55.0	37.3	60.2	37.9	58.6	26.3	71.2	36.2	61.4	15.5	82.2
Multivariable Model‡	1.1	(0.6–2.0)	1.3	(0.7–2.5)	1.3	(0.8–2.1)	1.1	(0.6–2.0)	0.9	(0.5–1.7)	2.5	(1.3–4.7)
Aggression												
High	36.8	60.5	32.5	64.9	50.9	46.5	28.1	69.3	29.0	68.4	15.8	81.6
Medium/Low†	43.0	54.7	37.5	60.1	37.2	59.3	26.1	71.4	36.8	61.0	15.8	82.0
Multivariable Model‡	1.2	(0.6–2.1)	1.3	(0.7–2.4)	1.8	(1.1–2.9)	1.7	(0.9–3.2)	0.7	(0.4–1.3)	0.7	(0.3–1.7)
Self-Regulation												
Low	30.4	67.2	22.9	74.1	39.8	56.7	19.9	77.6	34.3	63.2	15.4	82.1
Medium/High†	44.1	53.6	38.9	58.7	37.8	58.8	27.0	70.6	36.5	61.2	15.8	81.9
Multivariable Model‡	1.0	(0.6–1.7)	0.6	(0.4–1.0)	1.1	(0.8–1.6)	1.1	(0.7–1.7)	1.1	(0.7–1.6)	1.6	(0.8–3.3)

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Careful/Cautious												
Low	27.0	69.7	25.8	70.8	42.7	53.9	22.5	74.2	34.8	61.8	22.5	74.2
Medium/High†	43.4	54.3	37.8	59.8	37.8	58.8	26.4	71.1	36.4	61.4	15.5	82.3
Multivariable Model‡	0.8	(0.4–1.7)	0.8	(0.4–1.5)	1.0	(0.6–1.7)	1.2	(0.6–2.6)	0.9	(0.5–1.6)	1.7	(0.6–4.3)
Responsible Conduct												
Low	30.8	67.5	24.3	74.0	35.5	62.1	18.9	79.3	28.4	69.8	13.0	85.2
Medium/High†	43.8	53.8	38.5	59.0	38.3	58.2	26.9	70.5	37.1	60.6	16.1	81.6
Multivariable Model‡	0.7	(0.5–1.2)	0.7	(0.4–1.1)	0.8	(0.5–1.1)	0.8	(0.5–1.3)	0.7	(0.4–1.0)	0.6	(0.3–1.5)

* Adjusted for within-household correlation using GEEs (Liang and Zeger, 1986) and weighted for non-response (Horvitz and Thompson, 1952; Mongin, 2001)

† Referent category

‡ Models included gender, age, body mass index, number of hours worked on operation, parents' average age, parents' highest education level, number of children in household, operation state, operation type, operation income, and four remaining behavioral scales

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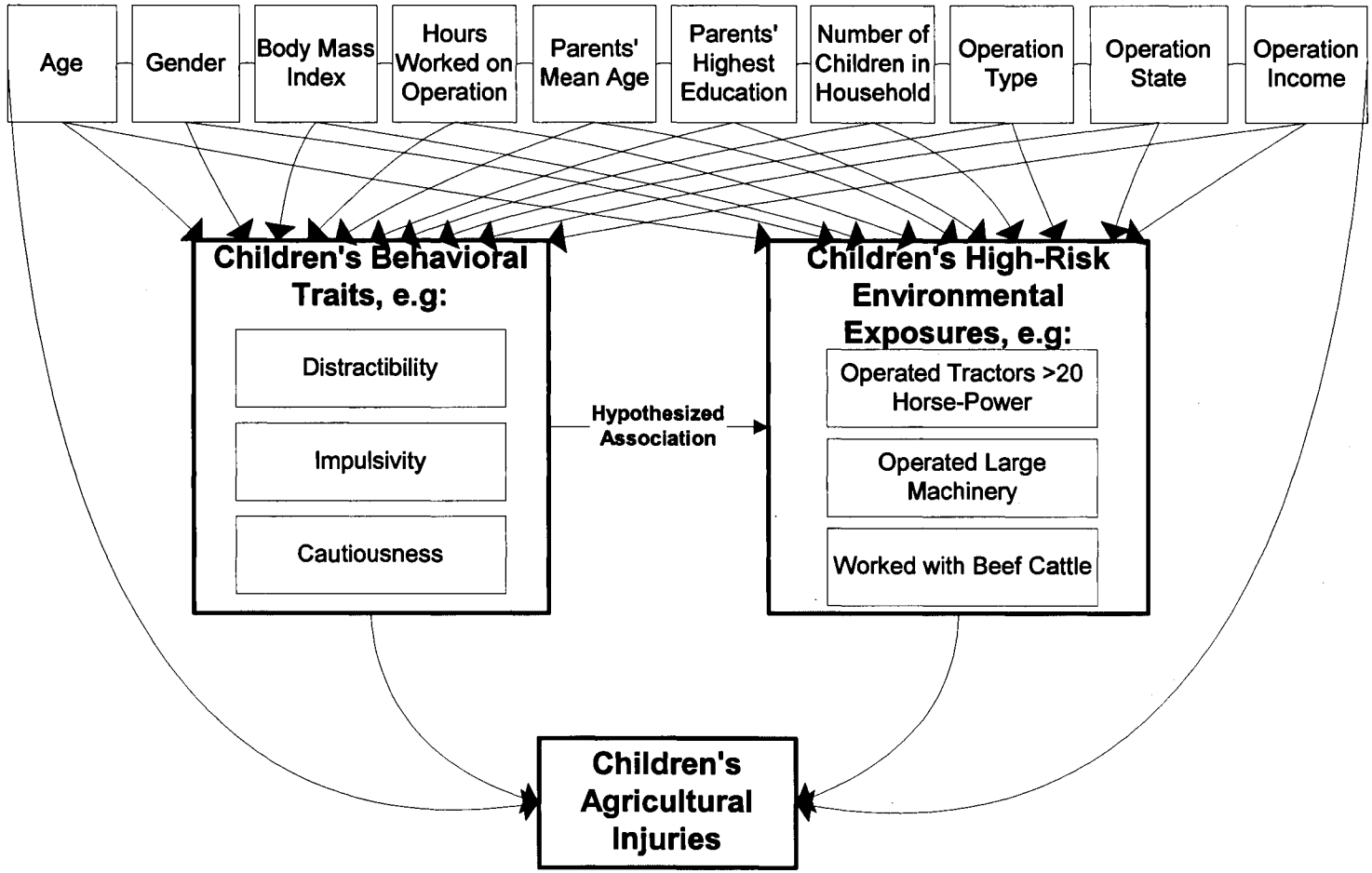
FIGURE 1: CAUSAL MODEL

Associations between Children's Behavioral Traits, High-Risk Exposures, and Agricultural Injury: Regional Rural Injury Study – II (RRIS-II)



ADDENDUM: UNCERTAINTY ANALYSES

Priors and Resulting Distributions of Select RR_{CAUSAL} Estimates: Regional Rural Injury Study – II (RRIS-II)

A. Priors: High vs. Medium/Low Depressive Symptoms and Likelihood of Working with Dairy Cattle

Estimated Odds Ratio: 2.7

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.92; exposed non-cases = 0.84;

unexposed cases = 0.84; unexposed non-cases = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed non-cases = 0.80

unexposed cases = 0.88; unexposed non-cases = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed non-cases = 0.95

unexposed cases = 0.96; unexposed non-cases = 0.99

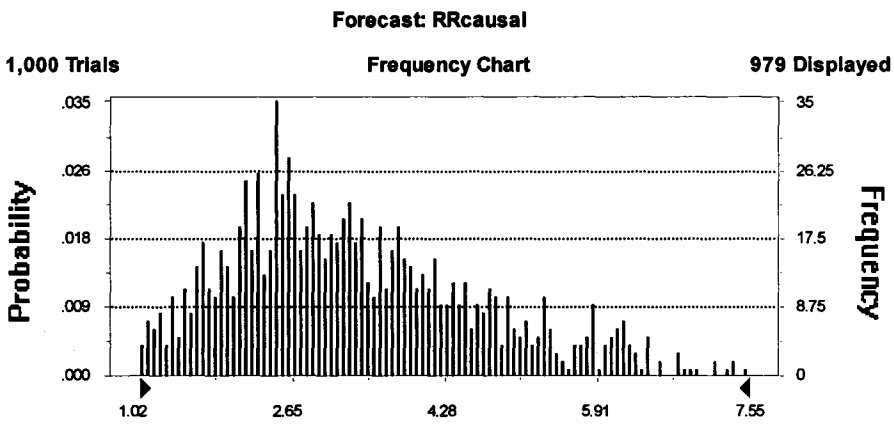
Missing Data: Triangular Distributions

cases: range = 0 – 7; likeliest value = 6

controls: range = 0 – 36; likeliest value = 22

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 3.5; Range = 1.0 – 12.4



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B. Priors: High vs. Low Aggression and Likelihood of Riding on Tractors

Estimated Odds Ratio: 1.7

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.96; exposed non-cases = 0.90;

unexposed cases = 0.98; unexposed non-cases = 0.92

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed non-cases = 0.80

unexposed cases = 0.88; unexposed non-cases = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed non-cases = 0.95

unexposed cases = 0.96; unexposed non-cases = 0.99

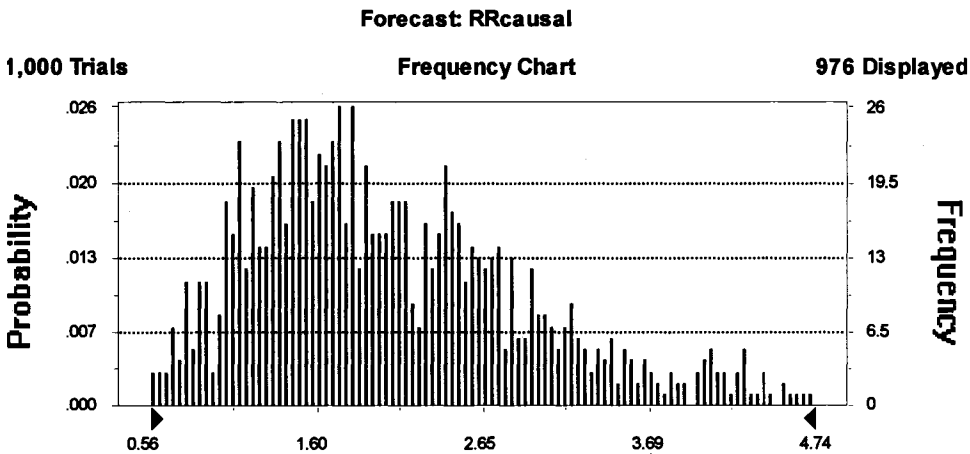
Missing Data: Triangular Distributions

cases: range = 0 – 7; likeliest value = 6

controls: range = 0 – 35; likeliest value = 21

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 2.2; Range = 0.6 – 6.8



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C. Priors: Low. Vs. Medium/High Self-Regulation and Likelihood of Operating Tractors

Estimated Odds Ratio: 0.5

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.92; exposed non-cases = 0.84;

unexposed cases = 0.84; unexposed non-cases = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed non-cases = 0.80

unexposed cases = 0.88; unexposed non-cases = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed non-cases = 0.95

unexposed cases = 0.96; unexposed non-cases = 0.99

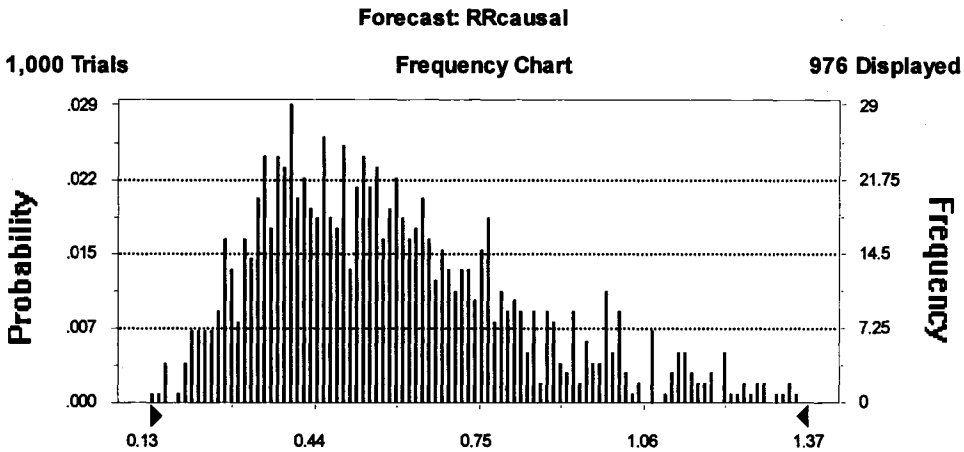
Missing Data: Triangular Distributions

cases: range = 0 – 7; likeliest value = 6

controls: range = 0 – 35; likeliest value = 21

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 0.6; Range = 0.1 – 2.0



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CHAPTER VI

PARENTS' AND CHILDREN'S AGRICULTURAL INJURIES

ABSTRACT

The objective of this study was to examine potential causal pathways to explain positive associations between parents' and children's agricultural injuries. It was hypothesized that the observed associations would be eliminated, or reduced, when accounting for important behavioral traits and high-risk agriculture-related work.

Analyses were based on data from the Regional Rural Injury Study – II (RRIS-II), a population-based, nested case-control study, which occurred in 1999 (Phase 1) and 2001 (Phase 2). For each phase, demographic, injury, and exposure data were collected for household members for one year. A total of 379 injured children (cases) and 1,562 randomly-selected controls, aged six to <20 years, were identified for current analyses. Children's risk of injury was estimated in reference to individual and combined parental injury experiences. Odds ratios (OR) and 95% confidence intervals (CI) were calculated, using logistic regression, for models controlling for demographic and exposure data (Model A), and models additionally controlling for high-risk behaviors and agricultural work (Model B). Directed acyclic graphs guided selection of these potential confounders.

No major differences were observed between Models A and B. While accounting for high-risk behaviors and agricultural work exposure, children whose fathers were injured prior to the study year had nearly twice the risk of injury as those whose fathers were not injured (OR=1.9, CI=1.4–2.5). Children also had increased risks of injury if their mothers were injured prior to the study (OR=2.1, CI=1.6–2.9) or during the study year (OR=2.1, CI=1.2–3.6). Those whose mothers were injured during both time periods had a five-fold increase in risk (OR=5.3, CI=2.4–11.9). Further, children whose parents both reported agricultural injuries prior to the study were three times more likely to be injured, compared to those with neither parent injured (OR=3.1, CI=2.2–4.6).

These results indicate that further, complex factors, beyond the incorporated behaviors and exposures, are driving the observed parent-child injury associations. There is a need for development of family-focused intervention strategies, and for further research into the social, physical, and behavioral environments driving these associations.

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BACKGROUND

Injury is the primary cause of death and disability among children in the United States (US) (National Center for Health Statistics, 2004). For children living on agricultural operations, the risk of fatal and nonfatal injury is substantially greater (Hard et al., 1999). Children's contributions to farm and ranch tasks are valued for financial (Kim and Zepeda, 2004a; 2004b) as well as socio-cultural (Lee et al., 1997) reasons, making high-risk occupational exposures, not usually sustained by children, relatively common. However, children who are not actively engaged in work activities are also at high risk of injury due to the proximity between family households and work environments (Pickett et al., 2005; Wilk, 1993). In response to this issue, the reduction of children's agricultural injuries has been a national initiative since 1996 (Castillo et al., 1998) and major efforts to understand and prevent these injuries have followed.

Prior research has shown that risk of agricultural injury is greater among children whose parents have sustained prior agricultural injuries (Carlson et al., 2006). Based on various conditioning, or learning, theories, one may expect to observe the opposite. However, given that sibling injury is a risk factor for children's injuries (Johnston et al., 2000; 2003), and past injury is a risk factor for re-injury (Spady et al., 2004; Westaby and Lee, 2003), it is possible that the social and physical environments to which individuals and families are exposed contribute more strongly to intra-familial risk than do past experiences. While the parent-child agricultural injury associations were observed while controlling for type of agricultural operation, further shared environmental exposures, not accounted for in the analyses, likely confounded this finding.

Improved knowledge of the causal mechanisms driving injury risk within families could enhance intervention efforts, particularly for the prevention of children's agricultural injuries on farms and ranches. The purpose of this study was to use a comprehensive database to further examine potential causal pathways that could explain the positive associations between parents' and children's agricultural injuries. As behavioral traits (Saudino et al., 2005), as well as physical environments, are shared by parents and their children, it was hypothesized that parent-child injury associations would

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be mediated through children's high-risk behavioral traits and their exposures to agricultural work.

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METHODS

Overview

The prior study, by Carlson et al. (2006), was based on data from Phase I of the Regional Rural Injury Study – II (RRIS–II). The current study builds on these previous results by using combined data from Phase 1 (1999) and Phase 2 (2001) of the RRIS-II. This RRIS-II was a prospective, population-based study of injuries among agricultural household members in a five-state region of the US, and included a nested case-control study of agricultural injuries involving children younger than 20 years of age (<20) (Gerberich et al., 2004). This study was approved by the University of Minnesota, Institutional Review Board, Human Subjects Committee.

Study Population

For each phase, a random sample of 16,000 agricultural operations was generated (n=3,200 each from Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin) using the US Department of Agriculture's National Agricultural Statistics Service Master ListFrame of Farming Operations. Eligible operations had to have produced ≥$1,000 of agricultural goods in the year prior to the study, and/or have land enrolled in a Conservation Reserve Program, and be actively engaged in farming/ranching as of January 1 of the study year. In addition, the operator's household had to be associated with the farm or ranch and include children <20 in residence as of January 1. A total of 8,810 (28%) of the farms/ranches were found to be eligible and, of these, 7,420 (84%) participated in the respective full study. Demographic and injury data were collected for 32,602 household members, over half of which were children.

Data Collection

Subsequent to introductory mailings, computer-assisted telephone interviews were conducted to obtain informed consent, establish eligibility, and enroll households. As an incentive to participate, all sampled operations were eligible for drawings that provided at least a one in 32 probability of receiving a $100 US Savings Bond.

For each phase, participating households received packets containing study details and materials to facilitate collection of information during each of two full-length interviews. The interviews occurred in July of the study year, and January of the

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following year, and collected information on each respective six-month recall period (January-June; July-December). Non-respondents for whom eligibility status was not established were sent a one-page survey to ascertain eligibility of the household.

The female head of household was the primary respondent for demographic and injury data, while the male head of household was preferred for operation exposure information. With parents' permission, children 12+ years were requested as their own respondents. The proxy for those who refused, and children <12, was the female head of household.

Children's Injury

The current analyses were based on data collected for children, ages six to <20 years, involved in the nested case-control effort. Cases were all agricultural injury events associated with their own operation and sustained during the reporting periods. An agricultural injury was defined as any event resulting from activities or objects associated with the family agricultural operation leading to restriction of normal activities for four hours or more, and/or loss of consciousness, or awareness, or amnesia, for any length of time, and/or treatment by a health professional.

The control population came from households randomly sampled to achieve a minimum ratio of three controls per case. To account for seasonal trends in injury incidence, injury rates from the most recent, similar study were used to estimate the number of controls needed: Phase 1 selection was based on data from the Regional Rural Injury Study – I (RRIS–I; Gerberich et al., 1993) while Phase 2 selection was based on Phase 1 data (Gerberich et al., 2003). An incidence-density sampling scheme was used to sample from the agricultural injury-free person-time experience (months) of children in residence on the operation. One child with at least one agricultural injury-free month was randomly selected from each sampled household.

The exposure experience was collected for the month before the month of injury for cases, and the month before an agricultural injury-free month for controls, sampled to reflect expected monthly incidence rates. This method allowed cases to be sampled as controls for months in which they did not sustain an agricultural injury.

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Parental Injury

Agricultural injury data were also collected for respondents identified as children's mothers and fathers. Each parent was asked if they had incurred an agricultural injury prior to, or during, the study year. Children were categorized as having a father, a mother, or both parents injured any time prior to, or during, their respective study period. To address the temporal nature of the study question, parents' injuries during the study period had to occur prior to the case injury month. For controls, parents' injuries had to occur prior to a randomly selected "target" month. Each parent's injury experiences were also combined to reflect their overall injury history.

High-Risk Behaviors and Work Exposures

The primary purpose of these analyses was to assess behavioral traits and environmental exposures as potential mediators in the associations between parents' and children's agricultural injuries. To account for children's high-risk behaviors, responses to 18 behavioral items, adapted primarily from the Parent Observation of Child Adaptation (POCA) checklist (Ialongo et al., 1999), were used to form five behavior scales relevant to the agricultural population. These were: (1) Depression: Child looked sad or down; had low energy; was irritable (Cronbach's alpha = 0.58), (2) Aggression: Child broke rules; got into fights; was impulsive (alpha = 0.51), (3) Self-Regulation: Child was easily distracted; paid attention; had good concentration; worked hard (alpha = 0.78), (4) Careful/Cautious: Child was careful; was cautious (alpha = 0.58), and (5) Responsible Conduct: Child completed work; followed rules (alpha = 0.60). Scores were categorized to represent the least desirable level of the behavior (to the extent possible, those within the 10^{th} percentile tail) as well as more moderate (10^{th} to $<50^{th}$ percentile) and desirable (50^{th} to 100^{th} percentile) levels.

High-risk work exposure was assessed using a similar scale design. Aggregate scores were calculated based on yes/no responses to interview questions ascertaining children's involvement in agriculture-related chores. The risks of injury for each of these chores (estimated with odds ratios) were multiplied for each affirmative response to ten items: operated motor vehicles (OR=1.9), tractors (OR=1.7), large machinery (OR=1.6), small tools (OR=1.4), or other equipment (OR=1.5); and, worked with horses (OR=1.7),

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beef cattle (OR=2.3), dairy cattle (OR=1.4), swine (OR=1.5), and poultry (OR=1.8). Scores were categorized to reflect children within the highest 10^{th} percentile, 10^{th} to $<50^{th}$ percentile, and 50^{th} to 100^{th} percentile of scores.

Data Analysis

Multivariable logistic regression was used to estimate risk of agricultural injury to children, subsequent to parental agricultural injury, while controlling for potentially confounding covariates (Breslow and Day, 1987). Odds ratios (OR) and 95% confidence intervals (CI) were calculated, using logistic regression, for models controlling for demographic and exposure data (Model A), and models additionally controlling for high-risk behaviors and agricultural work (Model B). To determine potential confounders, a causal model (**Figure 1**) was used for design and use of directed acyclic graphs (DAGs), following the methods in Greenland et al. (1999) and Hernán et al. (2002). This model also identifies the hypothesized causal pathways between parents' and children's injuries through parents' behavioral traits at t_0 and t_1, children's behavioral traits, and children's work exposures. These pathways were tested by analyzing associations between parents' and children's injuries while statistically controlling for children's behavior and work exposure scales. For parent-related covariates included in the models, data specific to fathers or mothers were used for the respective analyses of fathers' and mothers' injuries. For analyses of combined parental injury history, mothers' data were used.

Results were adjusted for within-household correlation using generalized estimating equations (Liang and Zeger, 1986). To partially account for selection bias, non-response was addressed at the household level by weighting observed responses with inverse probabilities of response (Horvitz and Thompson, 1952), based on characteristics from the Master ListFrame (operation state; operation type; annual revenue by quintile). To account for unknown eligibility among non-respondents, probability of eligibility was estimated for these same characteristics and used to adjust weights (Mongin, 2001). Exposure status (i.e., parents' injuries) was missing for three to seven percent of children for each analysis; thus, a separate exposure level was created, in each model, to evaluate risk of injury for these children.

Bias Evaluation

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Probabilistic uncertainty analyses were conducted to estimate the likely magnitude and direction of bias due to potential study errors, including residual confounding, measurement error, selection bias (sampling bias, losses to follow-up, non-response, and missing data), and specification bias. Using methods similar to those of Vose (2000) and described by Maldonado (unpublished manuscript, 2006), the robustness of each model was assessed while simultaneously accounting for estimated biases from each of these sources.

Assuming no other issues of validity, estimated odds ratios from this study were the products of true odds ratios (i.e., effects of parents' agricultural injuries on children's risk), all bias factors, and random error. Using Crystal Ball Risk Analysis Software (Decisioneering, 1998), Monte Carlo simulations were used to forecast the product of the bias factors and, then, the distribution of probable true odds ratios for each independent variable. Priors were specified based on assumptions of the differential effects of the error sources on results for each analysis; priors are identified for select analyses in the study **Addendum**.

Briefly, values for residual confounding were centered at one but were allowed to vary by ten percent, assuming uniform distributions. Expecting recall bias to be the greatest source of measurement error; baseline values for correct recall were identified for each exposure, and allowed to vary for each cell in the respective 2x2 tables. Normal distributions with standard deviations equaling 10% of each value were also assumed. Sampling bias was calculated by centering mean values at one, assuming normal distributions, and setting standard deviations at 0.10. For non-response, the average response proportion for each 2x2 table was set to equal 84.2% (the RRIS-II response rate) with slight variations across each cell. Distributions were assumed to be normal, had standard deviations equaling 10% of each value, and were truncated at 0 and one. Similar criteria were used to address case and control non-response. For missing exposure data, triangular distributions were used to forecast proportions of cases and controls likely to be exposed, with peak values set toward the maximum. Specification bias was considered by assigning normal distributions with mean values of one, but standard deviations of 0.10, for each cell. Effects of random error were not considered in these analyses.

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RESULTS

A total of 8,810 (28%) of the farms/ranches were found to be eligible and, of those, 7,420 (84%) participated in the respective full study. In total, 379 eligible cases (95%) and 1,562 eligible controls (97%) participated and were included in the analyses.

Among the 379 cases and 1,562 controls aged six to <20 years, agricultural injuries before the study period were reported for 245 (65%) and 731 (47%) fathers and 123 (33%) and 267 (17%) mothers, respectively. During the study period, injuries were identified for 61 (16%) and 153 (10%) fathers and 33 (9%) and 64 (4%) mothers.

Participant Characteristics

Case versus control children more often resided in households affiliated with dairy operations (21% and 13%); controls were more often associated with field, forage, or specialty crop operations, or Conservation Reserve Programs (47% and 35%) (**Table 1**). Case households, compared with control households, worked more hours per week on their operations: 24% versus 13% worked 160 hours or more. Nearly 21% of case households had four or more children in residence, compared with 13% of control households. Control households more often had only one child in residence (30% versus 16%). There were few differences between cases and controls by parents' age or educational status.

Although differences were slight, case versus control children were more likely to have scores within the least desirable 10^{th} percentile of behavioral scales (data not shown), including depressive symptoms (7% and 4%), aggression (8% and 6%), and careful/cautious behavior (22% and 16%). For work exposure, 21% of cases and 9% of controls scored within the highest 10^{th} percentile of the scale, while most had more moderate (22% and 13%) or low (58% and 78%) scores.

Multivariable Analyses

There were no major differences between the results of Model A, which controlled for state, enterprise, operation income, number of children in the household, total household hours worked on operation, and parent's age and education levels, and those of Model B, which additionally controlled for children's behavioral traits and environmental exposures.

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As observed in Model B (**Table 2**), children of fathers who sustained an agricultural injury, before the study period, had nearly twice the risk of injury as those whose fathers did not report an injury (OR=1.9, CI=1.4–2.5), while those whose fathers were injured during the study period had a suggestive elevated risk (OR=1.3; CI=0.9–2.0). Children whose fathers were injured in both time periods also had a greater risk of injury than children whose fathers were never injured (OR=2.3; CI=1.4–3.7), as did those whose fathers were injured in either time period (OR=1.9; CI=1.4–2.5).

The risk of injury among children whose mothers were injured before the study period was also twice that for children whose mothers did not sustain an injury (OR=2.1; CI=1.6–2.9) (**Table 2**), A similar observation was made for children whose mothers were injured during the study period (OR=2.1; CI=1.2–3.6). The highest risk was observed among children whose mothers reported injuries both before and during the study year (OR=5.3; CI=2.4–11.9).

Compared to those with neither parent injured before the study period, increased risks of agricultural injury were observed for children with one (OR=1.5; CI=1.1–2.1) or both (OR=3.1; CI=2.2–4.6) parents injured (**Table 3**). If both parents were injured during either time period analyzed, children's risk was tripled (OR=3.1; CI=2.1–4.5), compared to those with neither parent ever injured.

Uncertainty Analyses

The magnitude and direction of the effects of the parents' agricultural injuries on children's risk were largely unchanged when accounting for potential sources of study error. As identified in the **Addendum**, children whose fathers had incurred prior injuries had a mean odds ratio estimate of 2.6, while those whose mothers had incurred prior injuries or those whose parents both indicated prior injuries had mean estimates of 3.5 and 4.9, respectively. However, while mean ORs tended to be farther from the null than the adjusted multivariable ORs, identified in the Results section, the distributions of possible ORs for most exposures of interest included the null value of one. The ranges of possible ORs were 0.5–12.8 for fathers' prior injuries, 0.6–13.5 for mothers' prior injuries, and 0.6–18.9 for having both parents injured. Distribution charts for these examples are also identified (see **Addendum**).

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DISCUSSION

This study builds on previous findings identifying associations in parents' and children's risks of agricultural injury (Carlson et al., 2006). Results of the current study confirmed that parents' and children's agricultural injuries are positively associated, even while accounting for high-risk behavioral traits and agricultural work exposures. While surprising, this finding suggests that a more complex causal pathway, beyond that of the measured behaviors and work exposures, exists between parents' injury history and their children's risk.

Based on prior research, behavioral traits and work exposures were hypothesized to comprise the two major causal pathways explaining observed associations in parents' and children's injuries. First, given that mothers' prior injury experiences can lead to decreased injury hazards in the home (Russell and Champion, 1996), it was expected that parents' prior agricultural injuries would alter their safety-related behaviors on the farm or ranch. As children are known to model risk-taking and injury prevention behaviors after their parents, both among agricultural (DeBarr et al., 1998) as well as general population households (Darragh et al., 1998; Hu et al., 1994; White et al., 2000), enhanced safety behaviors among parents should have had preventive effects for children. Second, work exposures are also known to be shared by parents and children, and to influence injury risk. For example, Pryor et al. (2002) showed that supervision by a caregiver engaged in farm work, compared to in the home, led to increased risk of injury among children. Thus, in theory, controlling for both behavior- and exposure-related alternative pathways between parents' and children's injuries should have eliminated or reduced the observed associations.

That no mediation of parent-child injury associations was observed is not entirely inconsistent with prior studies. Other investigators have identified associations in injuries and risk-taking, even while accounting for similar covariates. For example, a large study involving a British birth cohort showed that, while controlling for demographic variables as well as aggressive behavior, which is a prominent risk factor for injury, children's injuries in the first five years of life predicted those in the next five years (Bijur, 1988). Further, a study of self-reported driving behavior identified strong associations between

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parents' and children's driving violations, even while controlling for demographic variables and hours of driving exposure (Bianchi and Summala, 2004). Across multiple studies, individual and familial injury associations have been consistent (Ferguson et al., 2001; Johnston et al., 2000; 2003; Low et al., 1996; Mistry et al., 2005; Spady et al., 2004); these associations appear to involve multiple and complex pathways that are not explained by behavioral or exposure factors, assessed separately, or in combination as in the current study.

It might be argued that the lack of observed mediation through high-risk behaviors and work exposures is due to risk compensation, or homeostasis, behavior. These theories purport that individuals will modify their behaviors so as to maintain a stable level of risk even in the presence of safety measures which reduce risk (O'Neill, 1977; Wilde, 1986); in this case, these theories would suggest that, even if an injured parent subsequently improves the safety of the operation environment, baseline levels of risk are met through alternative sources. However, these theories have had limited support from empirical studies of children's injuries (Pless et al., 2006). It is more likely that the current findings are due, at least in part, to a seemingly universal acceptance of injury and injury risk. Studies often show parents to believe that children's injuries are unpreventable or normative aspects of child development (Lewis et al., 2004; Morrongiello and Dayler, 1996). Not surprisingly, children of parents with who believe they have little control over injury risk are indeed more likely to be injured (Morrongiello and House, 2004).

It is also conceivable that high-risk behaviors and work exposures do explain the observed associations, but that residual confounding due to additional high-risk behaviors and/or exposures precluded this observation. The behavioral items assessed were limited in scope and number and yielded scales with relatively low internal consistency. While low alphas may have been a result of the few items included in each scale, they might also indicate limited interpretability of the factors used. Further, farming and ranching operations are complex, and our ability to fully account for shared environmental hazards is limited. Even among household environments, routine factors such as lighting or housekeeping have been found to increase children's risk of medically attended injuries

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(Mott, 1999). It would be prohibitively challenging to account for all such important factors in agricultural work environments through an observational study design.

Strengths and Limitations

Limitations, beyond those described above, should also be considered when interpreting results. For example, it may be reasoned that some families are better reporters of injuries than others, leading to misunderstanding of observed associations. However, the consistency in findings between this study and prior studies involving medical records data (Johnston et al., 2000; 2003; Mistry et al., 2005; Spady et al., 2004) indicates that intra-familial risk of injury is not solely an artifact of reporting bias.

Also, due to the self-reported nature of the data, results could potentially be a result of information bias; however, the use of six-month recall periods was expected to minimize recall bias, based on results of prior validation studies (Braun et al., 1994; Gerberich et al., 1990). While probabilistic uncertainty analyses indicated the magnitude and direction of most odds ratios to be largely unchanged in light of differential recall (in addition to other sources of error), there were limited data on which the specified priors could be based. Future studies that provide quantitative measurements of recall bias and other error factors, through validation studies or otherwise, would contribute substantially to this area of inquiry.

A particular strength of this study was the large number of participating eligible households (84%) and cases and controls (95% and 97%, respectively). While the high participation rates should adequately reduce the potential for selection bias to affect study results, an additional attempt to control such bias was made through adjustments for non-response and within-household correlation.

Conclusions

Despite potential limitations, the current findings add to our understanding of intra-familial injuries by examining high-risk behaviors and work exposures as potential mediators of observed parent-child injury associations. While associations between parents' past agricultural injuries and their children's risk of injury were maintained while accounting for these factors, more complex pathways, involving shared behaviors and environments, are still likely to explain this association. Despite unknown etiology,

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these findings indicate a need for interventions targeted at the family level and focused on improving the safety culture among families with injured parents. Further studies that simultaneously consider detailed social, physical, and behavioral environments will contribute substantially to this topic.

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REFERENCES

Bianchi A, Summala H: The "genetics" of driving behavior: Parents' driving style predicts their children's driving style. *Accident Analysis and Prevention*, 36: 655-659, 2004.

Bijur PE, Golding J, Haslum M: Persistence of occurrence of injury: Can injuries of preschool children predict injuries of school-aged children? *Pediatrics*, 82(5): 707-712, 1988.

Braun BL, Gerberich SG, Sidney S: Injury events: Utility of self-report in retrospective identification in the USA. *Journal of Epidemiology and Community Health,* 48(6): 604-605, 1994.

Breslow NE, Day NE: *Statistical methods in cancer research. Volume II - the design and analysis of cohort studies.* International Agency for Research on Cancer Scientific Publications, 82: 1-406, 1987.

Castillo D, Hard D, Myers J, Pizatella T, Stout N: A national childhood agricultural injury prevention initiative. *Journal of Agricultural Safety and Health Special Issue,* 1: 183-191, 1998.

Darragh AR, Stallones L, Sample PL, Sweitzer K: Perceptions of farm hazards and personal safety behavior among adolescent farmworkers. *Journal of Agricultural Safety and Health Special Issue*, 1: 159-169, 1998.

DeBarr KA, Ritzel DO, Wright WR, Kittleson MJ: Friends and family: Implications for youth tractor safety. *Journal of Safety Research*, 29(2): 87-95, 1998.

Decisioneering: *Crystal Ball Users Manual 2000.2.* Denver, CO: Decisioneering, Inc., 1998.

Ferguson SA, Williams AF, Chapline JF, Reinfurt DW, De Leonardis DM: Relationship of parent driving records to the driving records of their children. *Accident Analysis and Prevention*, 33(2): 229-234, 2001.

Gerberich SG, Alexander BH, Church TR, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR: *Regional Rural Injury Study – II, Phase 2: Agricultural Injury Surveillance.* A report to the Centers for Disease Control and Prevention. Minneapolis: Regional Injury Prevention Center, University of Minnesota, 2004.

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Gerberich SG, Gibson RW, French LD, Carr P, Renier CM, Gunderson P, Martin F, True J, Shutske J, Brademeyer K: *The Regional Rural Injury Study - I (RRIS-I): A population-based effort.* A Report to the Centers for Disease Control and Prevention, Minneapolis, Minnesota: Regional Injury Prevention Center, University of Minnesota, 1993.

Gerberich SG, Gibson RW, French LR, Church TR, Alexander BH, Shutske J, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR, Zhang X, Jensen KE: *Etiology and consequences of injuries among children in farm households: A regional rural injury study.* A report to the Centers for Disease Control and Prevention, Minneapolis, Minnesota: Regional Injury Prevention Center, University of Minnesota, 2003.

Gerberich SG, Gibson RW, Gunderson PW, Melton LJ III, French LR, Renier CM, Erdman AG, True JA, Carr WP, Elkington JM: Validity of trauma reporting in the agricultural community. *Journal of Occupational Accidents*, 12: 200, 1990.

Greenland S, Pearl J, Robins J: Causal diagrams for epidemiologic research. *Epidemiology*, 10(1): 37-48, 1999.

Hernán MA, Hernández-Díaz S, Werler MM, Mitchell AA: Causal knowledge as a prerequisite for confounding evaluation: An application to birth defects epidemiology. *American Journal of Epidemiology*, 155(2): 176-84, 2002.

Hard D, Myers J, Snyder K, Casini VJ, Morton L, Cianfrocco R, Fields J: Young workers at risk when working in agricultural production. *American Journal of Industrial Medicine Supplement*, 1: 31-33, 1999.

Horvitz DG, Thompson DJ: A generalization of sampling without replacement from a finite universe. *American Statistical Association Journal*, 47: 663-685, 1952.

Hu X, Wesson DF, Parlin PC, Chipman ML, Spence LJ: Current bicycle helmet ownership, use, and related factors among shool-aged children in metropolitan Toronto. *Canadian Journal of Public Health*, 85: 121-124, 1994.

Johnston BD, Grossman DC, Connell FA, Koepsell TD: High-risk periods for childhood injury among siblings. *Pediatrics*, 105(3): 562-568, 2000.

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Johnston BD, Grossman DC, Thompson RS: Transient elevation in risk of injury in siblings following injury encounters. *Journal of Pediatrics*, 142: 79-83, 2003.

Lewis T, DiLillo D, Peterson L: Parental beliefs regarding developmental benefits of childhood injuries. *American Journal of Health Behavior*, 28(S1): S61-S68, 2004.

Liang KY, Zeger SL: Longitudinal data analysis using generalized linear models. *Biometrics*, 73: 45-51, 1986.

Low JM, Griffith GR, Alston CL: Australian farm work injuries: Incidence, diversity and personal risk factors. *Australian Journal of Rural Health*, 4(3): 179-89, 1996.

Maldonado G: Adjusting a relative-risk estimate for study imperfections. Unpublished Manuscript, 2006.

Mistry RD, Hoffmann RG, Yauck JS, Brousseau DC: Association between parental and childhood emergency department utilization. *Pediatrics*, 115(2): e147-e151, 2005.

Mongin, SJ: *Adjustment for non-response in the Minnesota Nurses Study. Health Studies Research Report.* Division of Environmental and Occupational Health, University of Minnesota, Minneapolis, 2001. Available at: http://www1.umn.edu/eoh/NewFiles/resreports.html. Accessed July 15, 2006.

Morrongiello BA, Dayler L: A community-based study of parents' knowledge, attitudes and beliefs related to childhood injuries. *Canadian Journal of Public Health*, 87(6): 383-388, 1996.

Morrongiello BA, House K: Measuring parent attributes and supervision behaviors relevant to child injury risk: Examining the usefulness of questionnaire measures. *Injury Prevention*, 10: 114-118, 2004.

Mott JA: Personal and family predictors of children' medically attended injuries that occurred in the home. *Injury Prevention*, 5: 189-193, 1999.

National Center for Health Statistics: *National Vital Statistics Reports*. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 52(13), 2004.

O'Neill B: A decision-theory model of danger compensation. *Accident Analysis and Prevention*, 9: 157-165, 1977.

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Pickett W, Brison RJ, Berg RL, Zentner J, Linneman J, Marlenga B: Pediatric farm injuries involving non-working children injured by a farm work hazard: five priorities for primary prevention. *Injury Prevention*, 11: 6–11, 2005.

Pless IB, Magdalinos H, Hagel B: Risk-compensation behavior in children: Myth or reality? *Archives of Pediatrics and Adolescent Medicine*, 160(6): 610-614, 2006.

Pryor SK, Caruth AK, McCoy CA: Children's injuries in agriculture related events: the effect of supervision on the injury experience. *Issues in Comprehensive Pediatric Nursing*, 25: 189-205, 2002.

Russell KM, Champion VL: Health beliefs and social influence in home safety practices of mothers with preschool children. *Image: Journal of Nursing Scholarship*, 28(1): 59-64, 1996.

Saudino KJ, Ronald A, Plomin R: The etiology of behavior problems in 7-year-old twins: Substantial genetic influence and negligible shared environmental influence for parent ratings and ratings by same and different teachers. *Journal of Abnormal Child Psychology*, 33(1): 113-130, 2005.

Spady DW, Saunders DL, Schopflocher DP, Svenson LW: Patterns of injury in children: A population-based approach. *Pediatrics*, 113(3): 522-529, 2004.

Vose D: *Risk Analysis. A Quantitative Guide (2nd Edition)*. New York, NY: John Wiley & Sons, LTD, 2000.

Westaby JD, Lee BC: Antecedents of injury among youth in agricultural settings: A longitudinal examination of safety consciousness, dangerous risk taking, and safety knowledge. *Journal of Safety Research*, 34: 227-240, 2003.

White HR, Johnson V, Buyske S: Parental modeling and parenting behavior effects on offspring alcohol and cigarette use. A growth curve analysis. *Journal of Substance Abuse*, 12: 287-310, 2000.

Wilde GJS: Beyond the concept of risk homeostasis: Suggestions for research and application towards the prevention of accidents and lifestyle-related disease. *Accident Analysis and Prevention*, 18: 377-401, 1986.

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TABLE 1

Characteristics of Cases and Controls Six – <20 Years of Age: Regional Rural Injury Study – II (RRIS-II)

	Cases (n = 379)		Controls (n = 1,562)	
Characteristic	**n**	**(%)**	**n**	**(%)**
Gender				
Male	262	(69.1)	873	(55.9)
Female	117	(30.9)	689	(44.1)
Age (years)				
6 – <10	55	(14.5)	306	(19.6)
10 – <14	138	(36.4)	419	(26.8)
14 – <20	186	(49.1)	834	(53.4)
Missing/Unknown/Refused	0	(0.0)	3	(0.2)
Operation State				
Minnesota	49	(12.9)	299	(19.1)
Nebraska	91	(24.0)	345	(22.1)
North Dakota	72	(19.0)	282	(18.1)
South Dakota	93	(24.5)	369	(23.6)
Wisconsin	74	(19.5)	267	(17.1)
Type of Operation Requiring Most Time				
Beef cattle	110	(29.0)	422	(27.0)
Dairy cattle	81	(21.4)	201	(12.9)
Other animals	47	(12.4)	154	(9.9)
Field, forage, specialty crops; conservation reserve Program (CRP); or nothing during month of inquiry	131	(34.6)	740	(47.4)
Missing/Unknown/Refused	10	(2.6)	45	(2.9)
Operation Income				
<15,000	45	(11.9)	138	(8.8)

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15,000 – <30,000	99	(26.1)	413	(26.4)
30,000 – <50,000	118	(31.1)	482	(30.9)
50,000 +	79	(20.8)	331	(21.2)
Missing/Unknown/Refused	38	(10.0)	198	(12.7)
Number of Children in Household				
1	61	(16.1)	472	(30.2)
2	137	(36.2)	546	(35.0)
3	101	(26.7)	346	(22.2)
4+	80	(21.1)	195	(12.5)
Missing/Unknown/Refused	0	(0.0)	3	(0.2)
Total Household Hours Worked/Week on Operation				
≤40	22	(5.8)	256	(16.4)
41 – 80	79	(20.8)	459	(29.4)
81 – 120	120	(31.7)	419	(26.8)
121 – 160	66	(17.4)	228	(14.6)
≥160	92	(24.3)	200	(12.8)
Fathers' Age (years)				
20 – 35	34	(9.0)	99	(6.3)
36 – 45	210	(55.4)	760	(48.7)
>45	124	(32.7)	645	(41.3)
Missing/Unknown/Refused	11	(2.9)	58	(3.7)
Fathers' Education Level				
High school graduate, GED, or less	185	(48.8)	712	(45.6)
Some technical school or technical school graduate	48	(12.7)	220	(14.1)
Some college, college graduate, post-graduate, or professional school	133	(35.1)	569	(36.4)
Missing/Unknown/Refused	13	(3.4)	61	(3.9)
Mothers' Age (years)				

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20 – 35	60	(15.8)	191	(12.2)
36 – 45	238	(62.8)	845	(54.1)
>45	68	(17.9)	428	(27.4)
Missing/Unknown/Refused	13	(3.4)	98	(6.3)
Mothers' Education Level				
High school graduate, GED, or less	124	(32.7)	515	(33.0)
Some technical school or technical school graduate	47	(12.4)	230	(14.7)
Some college, college graduate, post-graduate, or professional school	193	(50.9)	717	(45.9)
Missing/Unknown/Refused	15	(4.0)	100	(6.4)

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TABLE 2

Risk of Children's Agricultural Injury by Fathers' and Mothers' Injury Histories: Regional Rural Injury Study – II (RRIS-II)

	Cases n = 379		Controls n = 1,562		Multivariable Analysis A[†]	Multivariable Analysis B[‡]
Fathers' Injury Status	**n**	**(%)**	**n**	**(%)**	**OR* (95%CI)**	**OR* (95%CI)**
Injured Prior to Study						
Yes	245	(64.6)	731	(46.8)	1.9 (1.5–2.5)	1.9 (1.4–2.5)
No	120	(31.7)	769	(49.2)	Referent	Referent
Missing	14	(3.7)	62	(4.0)	1.4 (0.6–2.9)	1.4 (0.6–3.0)
Injured During Study						
Yes	61	(16.1)	153	(9.8)	1.5 (1.0–2.4)	1.5 (0.9–2.5)
No	305	(80.5)	1,349	(86.4)	Referent	Referent
Missing	13	(3.4)	60	(3.8)	0.9 (0.4–1.9)	0.9 (0.4–2.2)
Ever Injured						
One Time Period	210	(55.4)	676	(43.3)	1.9 (1.5–2.6)	1.9 (1.4–2.5)
Both Time Periods	48	(12.7)	103	(6.6)	2.5 (1.6–4.0)	2.3 (1.4–3.7)
Neither Time Period	107	(28.2)	721	(46.2)	Referent	Referent
Missing	14	(3.7)	62	(4.0)	1.4 (0.7–3.1)	1.5 (0.7–3.2)
Mothers' Injury Status	**n**	**%**	**n**	**%**		

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Injured Prior to Study						
Yes	123	(32.5)	267	(17.1)	2.2 (1.6–2.9)	2.1 (1.6–2.9)
No	241	(63.6)	1,195	(76.5)	Referent	Referent
Missing	15	(4.0)	100	(6.4)	1.1 (0.5–2.3)	1.2 (0.6–2.4)
Injured During Study						
Yes	33	(8.7)	64	(4.1)	2.1 (1.1–4.2)	2.1 (1.2–3.6)
No	330	(87.1)	1,399	(89.6)	Referent	Referent
Missing	16	(4.2)	99	(6.3)	1.2 (0.6–2.4)	1.0 (0.5–2.1)
Ever Injured						
One Time Period	114	(30.1)	285	(18.3)	1.9 (1.4–2.5)	1.8 (1.3–2.5)
Both Time Periods	21	(5.5)	23	(1.5)	5.5 (2.6–12.0)	5.3 (2.4–11.9)
Neither Time Period	228	(60.2)	1,154	(73.9)	Referent	Referent
Missing	16	(4.2)	100	(6.4)	1.2 (0.6–2.5)	1.3 (0.6–2.8)

* Adjusted for within-household correlation using GEEs (Liang and Zeger, 1986) and weighted for non-response (Horvitz and Thompson, 1952; Mongin, 2001)

† Models included state, enterprise, operation income, number of children in the household, total household hours worked on operation, and respective parent's age and education level

‡ Models included state, enterprise, operation income, number of children in the household, total household hours worked on operation, respective parent's age and education level, children's behaviors (depressive symptoms, aggression, self-regulation, careful/cautious

behavior, and responsible conduct) and work exposures (multiplicative scores based on odds ratios for each affirmative response to: operated motor vehicles, tractors, large machinery, small tools, or other equipment; and worked with horses, beef cattle, dairy cattle, swine, and poultry)

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TABLE 3

Risk of Children's Agricultural Injury by Parents' Combined Injury History: Regional Rural Injury Study – II (RRIS-II)

	Cases n = 379		Controls n = 1,562		Multivariable Analysis A†	Multivariable Analysis B‡
Parent Injury Status	**n**	**(%)**	**n**	**(%)**	**OR* (95%CI)**	**OR* (95%CI)**
Prior to Study						
Both Injured	107	(28.2)	183	(11.7)	3.4 (2.4–4.9)	3.1 (2.2–4.6)
One Injured	148	(39.1)	596	(38.2)	1.5 (1.1–2.0)	1.5 (1.1–2.1)
Neither Injured	103	(27.2)	669	(42.8)	Referent	Referent
Missing	21	(5.5)	114	(7.3)	1.7 (0.9–3.3)	1.8 (0.9–3.5)
During Study						
Both Injured	9	(2.4)	15	(1.0)	2.2 (0.4–11.4)	1.7 (0.2–19.4)
One Injured	75	(19.8)	179	(11.5)	1.7 (1.2–2.4)	1.8 (1.2–2.8)
Neither Injured	274	(72.3)	1,257	(80.5)	Referent	Referent
Missing	21	(5.5)	111	(7.1)	1.4 (0.7–2.6)	1.5 (0.8–3.0)
Either Time Period						
Both Injured	118	(31.1)	214	(13.7)	3.3 (2.3–4.8)	3.1 (2.1–4.5)
One Injured	150	(39.6)	622	(39.8)	1.6 (1.1–2.1)	1.6 (1.1–2.2)
Neither Injured	89	(23.5)	612	(39.2)	Referent	Referent

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Missing	22	(5.8)	114	(7.3)	2.0 (1.0–3.8)	2.1 (1.1–4.1)

* Adjusted for within-household correlation using GEEs (Liang and Zeger, 1986) and weighted for non-response (Horvitz and Thompson, 1952; Mongin, 2001)

† Models included state, enterprise, operation income, number of children in the household, mother's age and education level, and total household hours worked on the operation

‡ Models included state, enterprise, operation income, number of children in the household, total household hours worked on operation, respective parent's age and education level, children's behaviors (depressive symptoms, aggression, self-regulation, careful/cautious behavior, and responsible conduct) and work exposures (multiplicative scores based on odds ratios for each affirmative response to: operated motor vehicles, tractors, large machinery, small tools, or other equipment; and worked with horses, beef cattle, dairy cattle, swine, and poultry)

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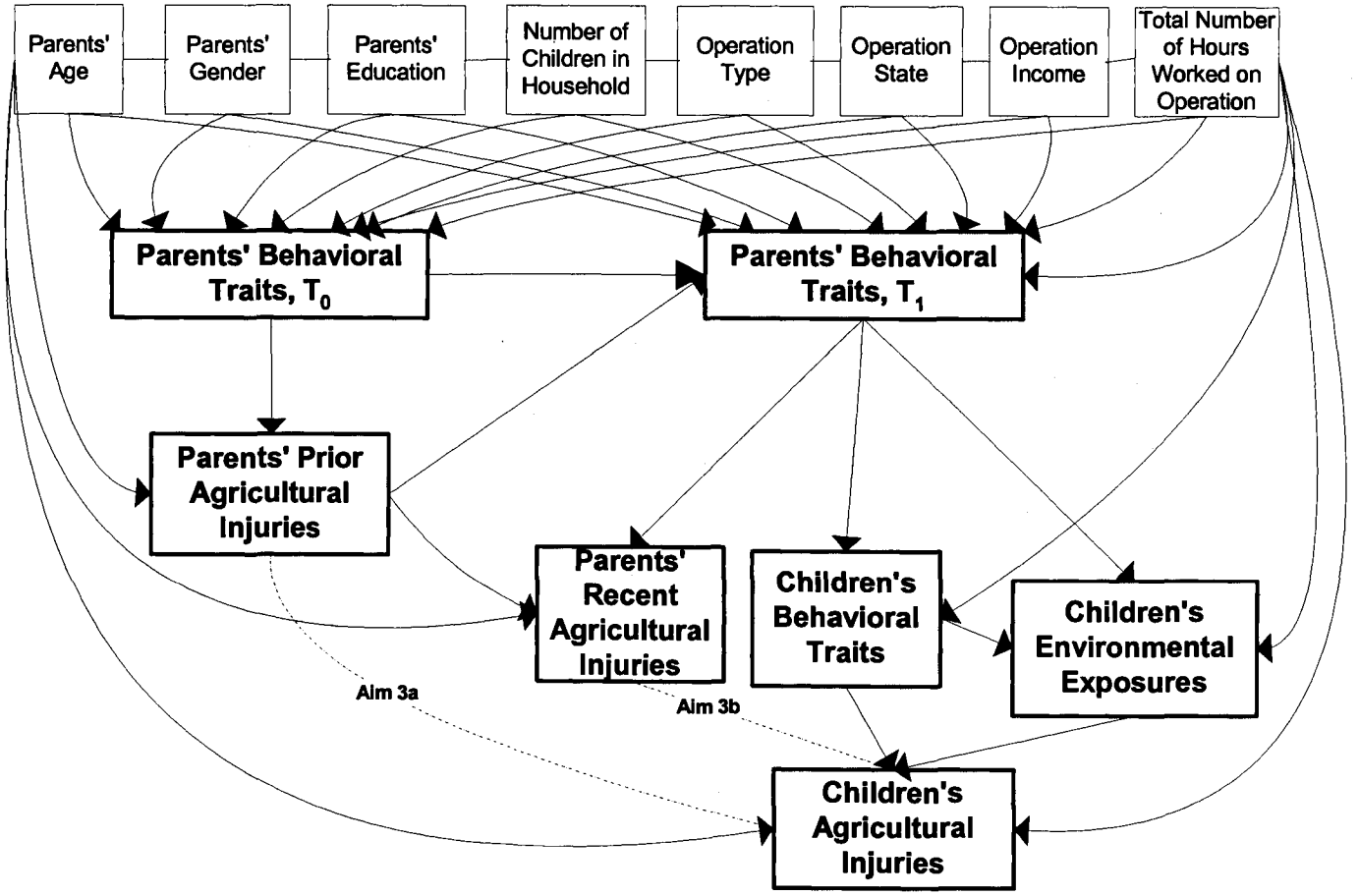
FIGURE 1: CAUSAL MODEL

Associations between Parents' and Children's Agricultural Injuries:

Regional Rural Injury Study – II (RRIS-II)



ADDENDUM: UNCERTAINTY ANALYSES

Priors and Resulting Distributions of Select RR_{CAUSAL} Estimates: Regional Rural Injury Study – II (RRIS-II)

A. Priors: Fathers Previously Injured vs. Not and Children's Risk of Injury

Estimated Odds Ratio: 1.9

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.90; exposed controls = 0.85;

unexposed cases = 0.95; unexposed controls = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

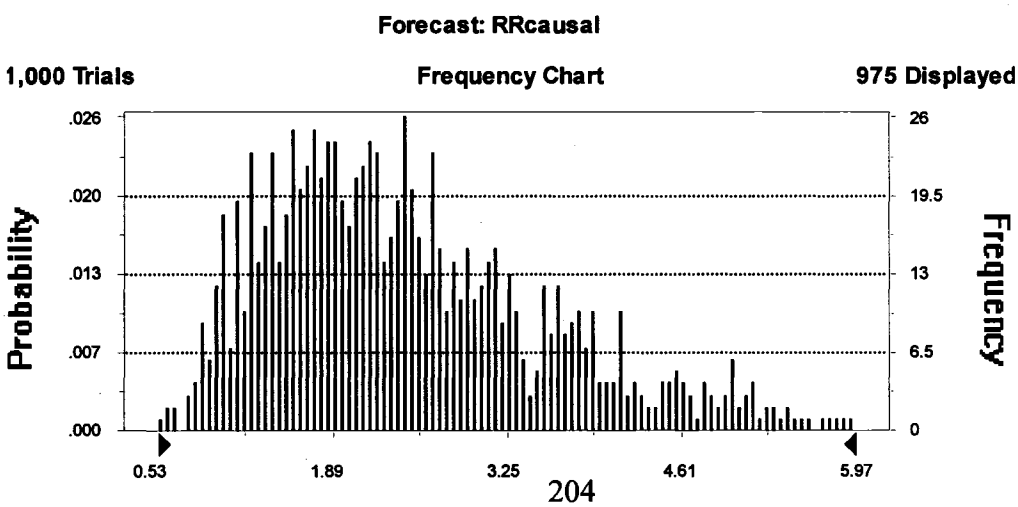
Missing Data: Triangular Distributions

cases: range = 0 – 14; likeliest value = 12

controls: range = 0 – 62; likeliest value = 50

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 2.6; Range = 0.5 – 12.8



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B. Priors: Mothers Previously Injured vs. Not and Children's Risk of Injury

C. Estimated Odds Ratio: 2.1

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.90; exposed controls = 0.85;

unexposed cases = 0.95; unexposed controls = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

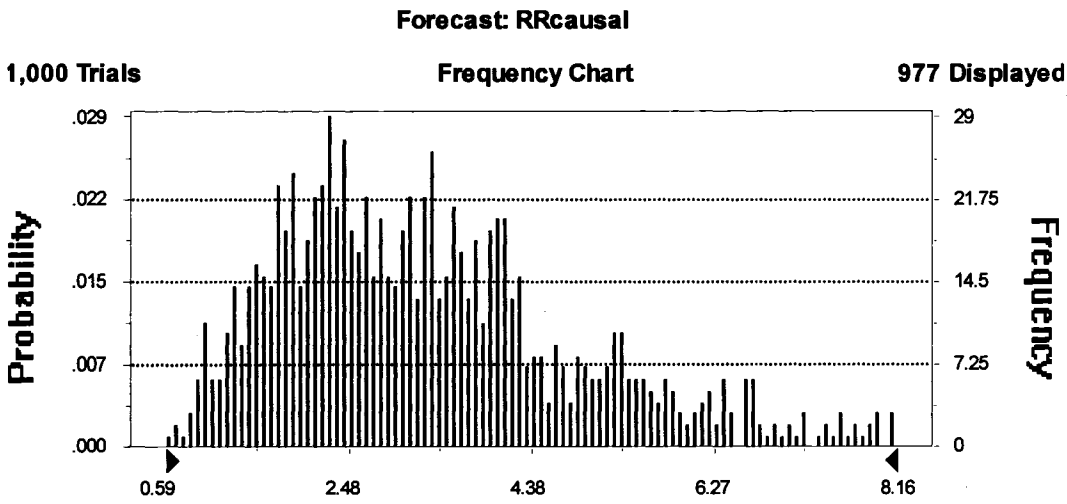
Missing Data: Triangular Distributions

cases: range = 0 – 15; likeliest value = 12

controls: range = 0 – 100; likeliest value = 80

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 3.5; Range = 0.6 – 13.5



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D. Priors: Both Parents Previously Injured vs. Neither Ever Injured and Children's Risk of Injury

Estimated Odds Ratio: 3.1

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.90; exposed controls = 0.85;

unexposed cases = 0.95; unexposed controls = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

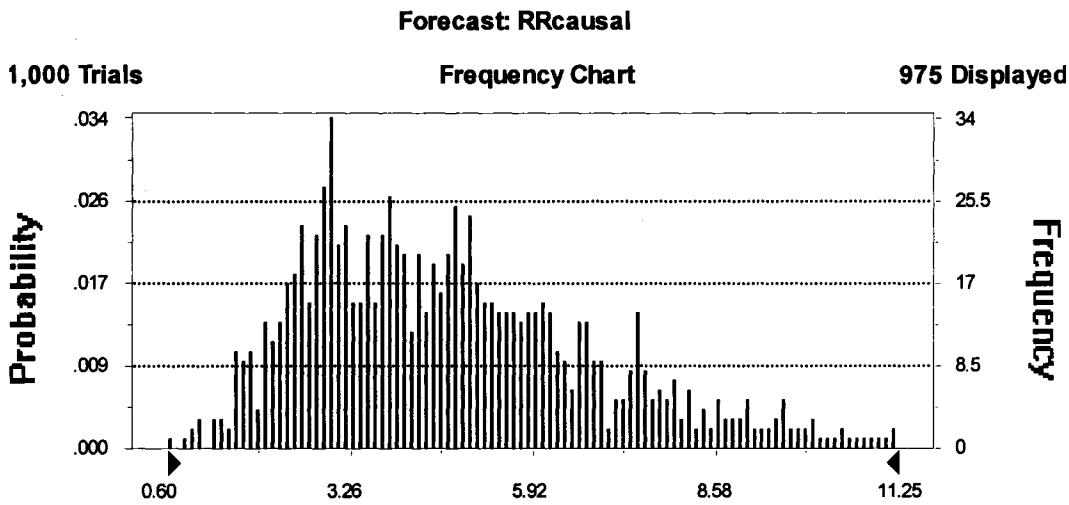
Missing Data: Triangular Distributions

cases: range = 0 – 15; likeliest value = 12

controls: range = 0 – 114; likeliest value = 90

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 4.9; Range = 0.6 – 18.9



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CHAPTER VII

DISCUSSION

This study was among the first to examine behavioral traits as potential risk factors for agricultural injuries to children living on farming and ranching operations. Multivariable analyses were used to assess associations between behaviors, high-risk environmental exposures, and injuries, using a comprehensive database from a large, population-based study; these factors were also examined within the context of observed intra-familial risks of injury.

This approach was unique and important, considering the magnitude and impact of agricultural injuries among rural North American households. As presented in earlier chapters, children are at an unusually high risk of occupational injury in agricultural settings, with fatality rates reaching 9.3 per 100,000 farm residents less than 20 years of age (<20) in the United States (Goldcamp et al., 2004), and 14.9 per 100,000 person-years among children one to six years of age in Canada – nearly twice the rate of all-cause, unintentional fatal injuries (Brison et al., 2006). The impact of children's agricultural injuries, both financial and emotional, is challenging to quantify but most certainly has substantial public health significance. Measures of hospitalization and other health care usage, lost work time, restricted activity, and residual effects have shown, to limited extent, the importance of understanding the risks and, ultimately, preventing these types of injuries (Gerberich et al., 2003; 2004; McGwin et al., 2000; Pratt et al., 1992).

While some social and environmental reasons for children's high risk of agricultural injury are understood (Gerberich 2001; 2003; 2004; Kelsey, 1994; Kim and Zepeda, 2004; Lee et al., 1997; Wilk, 1993), there is limited knowledge of the role played by behavioral characteristics, either in their high-risk exposures or their overall injury risk. This knowledge gap was made evident by results of a recent study that identified strong associations between parents' and their children's injuries (Carlson et al., 2006), calling into question the effect of shared or inherited behaviors on risk. Thus, the aims of this study were to shed more light on this area through an in-depth examination of children's behavioral traits and high-risk environmental exposures, culminating in an

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analysis of these factors as potential mediators in the observed parent-child injury associations.

Aim 1: Behavioral Risk Factors for Children's Agricultural Injury

Behavioral traits have been examined as potential risk factors for injury; more recently, however, this area of inquiry has subsided in favor of a more resolute focus on environmental hazards and passive interventions. Given that most injury events involve a complex series of interactions between individuals and their environments, though, a multifaceted approach to the prevention of children's injury is warranted. This is even more evident in the farming and ranching environment, where efforts to prevent children's agricultural injuries have either not been universally accepted or, where evaluated, have not been shown to have had substantial impact (DeRoo and Rautiainen, 2000; Hartling et al., 2004).

Behavioral factors may influence how individuals respond to hazards in the environment; for example, how they appraise the risk of injury from a particular hazard or whether they choose to avoid a hazard entirely. The traits most commonly characterized as injury risk factors are: (1) hyperactivity and attention-deficit hyperactivity disorder (ADHD) (Barkley et al., 1993; Bijur et al., 1986; Davidson et al., 1987; Farmer and Peterson, 1995; Lam et al., 2006; Langley et al., 1983; Manheimer and Mellinger, 1967; Matheny et al., 1971; Rowe et al., 2004; Schwebel et al., 2004; Wazana et al., 1997); (2) impulsivity (Bijur et al., 1986; Jaquess and Finney, 1994; Manheimer and Mellinger, 1967; Ryb et al., 2006; Schwebel and Plumert, 1999); and (3) aggression (Bijur et al., 1986; Chliaoutakis et al., 2002; Manheimer and Mellinger, 1967; Norris et al., 2000; Pulkinnen, 1995; Wazana et al., 1997). Other factors that have been analyzed are depression (Keogh et al., 2000; Peele and Tollerud, 2005; Rowe et al., 2004; Tiesman et al., 2006), negative affectivity (Frone, 1998; Sutherland and Cooper, 1991), type A personality (Sutherland and Cooper, 1991), and extraversion and neuroticism (Hansen, 1989).

Rural agricultural households comprise a unique population due to distinct socio-cultural factors, hazardous exposures, and high rates of occupational injury, particularly among children. The current study of children's behaviors and injury risk was distinct in

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that it explored behavioral items and scales that may drive the risk of agricultural injury among children in farming and ranching households. Behaviors that were examined include depression, aggression, self-regulation, careful/cautious behavior, and responsible conduct. Results of this study suggested that children's behaviors are, in fact, associated with their risk of agricultural injury. Specifically, children who almost never/sometimes (versus almost always/often): were cautious, planned carefully, or followed rules, had increased risks of injury; while those who almost never/sometimes: worked hard or paid attention had reduced risks. Similarly, children who almost always/often got into fights or broke rules had increased risks of agricultural injury. Elevated risks were also identified for children with high levels of depressive symptoms and aggression, and those with low levels for self-regulation and being careful/cautious.

Though some of the behavioral constructs examined appeared to have a unique interpretation for this population, the results were, in general, consistent with prior studies of behavior and injury. Across studies, aggression has been shown to be positively associated with risk of injury, particularly among children (Mannheimer and Mellinger, 1967; Bijur et al., 1986). For example, a study of medically-treated, unintentional injuries among nearly 12,000 preschool children showed those in the 90th percentile of aggression scores to have elevated risks for hospitalized and non-hospitalized injuries (Bijur et al., 1986). In the current study, children exhibiting high levels of aggression appeared to be at increased risk for agricultural injury, compared to children with low levels. This association may be due to increased risk-taking among those with aggressive personalities (Zuckerman and Kuhlman, 2000) which, on agricultural operations, could lead to more high-risk exposures than among children with lower tolerance for risk.

Another interesting finding in this study was the association between agricultural injuries and symptoms of depression. Children in the highest 10th percentile of aggregate scores had twice the risk as children with scores in the 50th to 100th percentile. To date, there has been limited evidence of any valid associations between depressive symptoms and risk of unintentional injury; a notable exception is a study by Peele and Tollerud (2005) which found that depression was associated with women's, though not men's,

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rates of occupational injuries. The current finding, pertinent to children of farming and ranching families, is highly relevant given the documented prevalence of depressive symptoms in this population (Fraser et al., 2005; Linn and Husaini, 1987; Scarth et al., 2000; Stallones et al., 1995).

Individual items as well as the averaged score for careful/cautious behavior were strongly associated with reduced risk of agricultural injury. These results were not surprising, given that children who are "planful" are less likely to engage in impulsive, risk-taking behavior (Caspi and Silva, 1995). This finding may, in part, reflect the contribution of a careful/cautious personality to the construct of conscientiousness. High scores for this trait, which includes "planful," in addition to dependability and prudence, have been shown to be associated with decreased fatal injuries in life-span survival analyses (Friedman, 2000). Further research has shown that conscientious parents have children who engage in less risk-taking behavior and are involved in fewer injury events (Morrongiello and House, 2004). On agricultural operations, children with conscientious, or careful/cautious, personalities might have decreased risks for a multitude of reasons. For example, these children might make use of current educational materials or prevention measures aimed at reducing risk of injury. Further development of this construct and its association with agricultural injury is warranted.

Though conclusions have been highly inconsistent, hyperactivity has been examined readily as a potential risk factor for children's injury (Davidson, 1987). Four items that comprise many hyperactivity scales (couldn't sit still; impulsive; acted without thinking; had good concentration) did not factor together in the current analyses, which suggests a distinct construct for these items within the agricultural community. The fact that the four individual items were not associated with injury seems to be consistent with most recent findings. While prior studies have shown activity-related measures to be associated with children's injury (Manheimer and Melinger, 1967; Langley et al., 1983; Bijur et al., 1986), findings from a more recent, prospective cohort study found no association between injury and overactivity, hyperactivity, or concentration problems (Davidson et al., 1988; 1992).

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On the contrary, factor analysis identified four items (child was easily distracted; had problems paying attention; had good concentration; worked hard) that were strongly related, with a Cronbach's alpha of 0.78; this factor was referred to as children's self-regulation. Interestingly, children with low levels of self-regulation were at half the risk of agricultural injury as children with high scores for this construct. This finding appeared to be counter to previous studies showing low self-regulation, and its related measures, to be associated with risk-taking (Steinberg, 2004) and increased risk of injury (Manheimer and Mellinger, 1967).

Of the four survey items comprising the self-regulation scale, "child worked hard," appeared to play an important and distinct role in this particular study population. Working hard is, in general, a positive trait and was therefore expected to be inversely associated with injury. Interestingly, a direct association was observed; children who almost never/sometimes worked hard had reduced risks of injury. While children's work hours were controlled in the regression analysis, residual confounding due to differential work pace or high-risk types of work might explain this association. It is likely that additional findings from the current analyses, such as reduced risks for those with low self-regulation, also reflect children's differential assignment to farm or ranch chores. Future research examining the potential association between children's behavioral traits and their specific environmental exposures could further elucidate the causal pathway between children's behaviors and their risk of injury.

Strengths and Limitations

While this study addressed a deficiency in current knowledge about children's behavioral traits and agricultural injury, potential limitations should be taken into account when interpreting results. Most importantly, analyses of behavioral items and injury data may have been influenced by recall bias. This issue was particularly relevant to the results pertinent to depression, given that these symptoms are commonly a result of injury (Keogh et al., 2000), but concern may also extend to other behavioral items and scales. While this potential source of bias should be considered, as well as further measurement and selection issues, multiple measures were taken to address these problems. Based on prior validation efforts (Gerberich et al., 1990; Braun et al., 1994), injury data were

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collected for six-month windows to limit information bias. Additionally, behavior-related items were measured in reference to the months prior to the injury events for cases, or randomly selected months for controls. Limited data, pertinent to agricultural operation state, size, and annual revenue by quintile, were also used in aggregate form to identify and adjust for differences in eligibility and response among households.

Given that a main intent of the RRIS–II was to serve as a tool for surveillance of environmental risk factors for agricultural injury, the behavioral items measured were limited in scope and number. The 18 items used were selected based on their deemed relevance to work and safety on agricultural operations. The *a priori* constructs, based mostly on the questionnaires from which the items were adapted, were modified based on results of exploratory factor analyses to yield the scales that were used; however, apart from self-regulation, Cronbach's alphas for each scale were relatively low. Low alphas may have resulted in part from the limited number of items included in each scale, but may also indicate limited interpretability for the factors used.

It is likely that the findings from this study reflected children's differential assignment to farm or ranch chores. While children's work hours were controlled in these regression analyses, residual confounding due to differential work pace or high-risk types of work might also have explained the observed associations between behaviors, such as "worked hard," and risk of injury. This possibility was addressed by the next set of analyses in this study, which examined the potential association between children's behavioral traits and their specific environmental exposures.

Aim 2: Behavioral Determinants of High-Risk Exposures

It is likely that some behavioral traits affect risk of injury, independently, while others may increase risk through intermediate environmental exposures. For example, children who are perceived as responsible by their parents may be assigned more chores than children perceived as irresponsible or immature; this would increase children's risk of injury, as hours of agricultural work exposure are associated in a dose-response manner with an increased risk of agricultural injury (Boyle et al., 1997; Elkington, 1990; Gerberich et al., 2003; Stueland et al., 1996; 1997). On the other hand, children who are easily distracted or impulsive may not be assigned as many or as hazardous of tasks due

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to protective parenting. The aim of this study was to empirically evaluate the potential associations between children's behavioral characteristics and their high-risk exposures.

Results indicated both positive and negative associations between children's behavioral characteristics and their high-risk work exposures. For example, children with high scores for depressive symptoms were more likely to work with dairy cattle, while those with high aggression scores were more likely to ride on tractors and operate large machinery. Children were less likely to operate tractors, however, if they had low levels of self-regulation or responsible conduct. Further, low levels of responsible conduct were associated with decreased work with beef cattle and horses. Children with low levels of careful/cautious behavior were more likely to be frequent bystanders in fields or barnyards.

While previous research has found that children's development (Rivara and Howard, 1982; Zebrowitz et al., 1991) and behaviors (Deković et al., 1997; Schwebel et al., 2006) influence relevant parenting patterns, this study appears to be the first to identify associations between children's behaviors and their involvement in, or exposure to, high-risk work environments. As described above, results of the Aim 1 analyses, involving the same data source as the current study, found that children with specific behavioral traits had greater risks of agricultural injury. In light of the current findings, this increased risk may have been due, in part, to parents' differential assignment of chores to these children.

For example, children with the highest aggregate scores for depressive symptoms had twice the risk of incurring an agricultural injury than children with moderate or low scores. Results of Aim 2 analyses showed that these children were also more likely to work with dairy cattle, an exposure which has been shown to increase risk of injury in prior studies (Gerberich et al., 2001). Further, children with high scores for aggression had nearly twice the risk of injury as those with moderate or low scores; this study identified that these children are also more likely to ride on tractors or machinery. Similar findings pertain to children with low levels of self-regulation. These children were at substantially decreased risk of agricultural injury, implying that children with high levels of self-regulation have increased risks. This counterintuitive finding suggests that parents

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of children with good self-regulation are assigning them more high-risk chores, perhaps earlier than developmentally or physically advisable. Findings from Aim 2 analyses supported this hypothesis, as these children were, indeed, more likely to be operating tractors. It is likely that this association is only part of a larger tendency for children with good self-regulation to be present in environments or involved in chores that, in actuality, increase their risk of injury.

Another interesting observation, overall, was that children with less desirable behaviors were exposed to dairy cattle more frequently than those with more moderate behavior levels. For example, children with high levels of depressive symptoms, those who almost never/sometimes liked to plan carefully or paid attention, and those who almost always/often were irritable, were identified as more likely to work with dairy cattle. Also, potentially high-risk children were more likely to be extra riders on tractors: those with high scores for aggression, and those who almost always/often were easily distracted, got into fights, or had low energy, had elevated odds ratios. These findings imply that parents differentially assign work with dairy cattle, or riding on tractors, to children with potentially high-risk behaviors; an important consideration given that both exposures are known to increase children's risk of injury (Gerberich et al., 2001; Hendricks et al., 2004).

It is known that parents take into consideration a large number of factors when assigning agriculture-related tasks or chores to their children (Kim and Zepeda, 2004b; Lee et al., 1997; Zebrowitz et al., 1991). It appears likely that parents also consider children's behavioral traits in determining readiness to perform chores. Whether these decisions are based on objective information or prior experience is unknown and should be explored further. It may be that parents consider the severity of potential injuries when differentially assigning chores or exposures to children. Of the work exposures examined, children with undesirable behaviors were more often at reduced risk of working with tractors or machinery: children with low levels of self-regulation or responsible conduct were less likely to have operated tractors, as were children who almost never/sometimes had good concentration or almost always/often broke rules, while children who almost never/sometimes completed work/chores or worked hard were less likely to have

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operated large equipment. While animals are frequent sources of nonfatal injury among children, tractor- or machinery-related injuries tend to have grave consequences, including severely disabling and fatal injuries (Pickett et al., 1999). Given that farm and ranch families believe children's participation in work to be important for their social development (Kim and Zepeda, 2004a), it is feasible that parents balance children's risks by conscientiously assigning chores with potentially less severe consequences to higher-risk children.

These results may hold interesting implications for development of education-based intervention measures. Evaluative studies of current efforts have shown that parents often assign age-inappropriate tasks to their children (Pickett et al., 2003), despite relatively thorough understanding of child development (Mason and Earle-Richardson, 2002). Results of this study indicate that parents recognize and respond to children's potential high-risk behaviors. Future educational interventions might consider parental assessment of children's behaviors in determining age- and developmental-appropriateness for high-risk work exposure. The tendency for parents to assign potentially hazardous chores to children with high-risk behaviors might also be taken into consideration in future efforts.

Strengths and Limitations

Given the observational nature of these data, results should be interpreted in light of potential limitations. While the multivariable analyses controlled for a number of potential confounders, including type of enterprise, operation income, children's hours worked, parents' education levels, and number of children in the household, the potential for an additional, unmeasured confounder cannot be ruled out. For example, parenting factors, such as supervision, could explain some children's behaviors and also affect their risk of injury. Further, data on children's behaviors and exposures may have been susceptible to recall bias as these were assessed simultaneously for each six-month reporting period. However, many steps were implemented during the data collection and analysis phases in order to limit these potential biases. For example, use of the six-month recall period for collection of exposure data, and restriction of the etiologic time period to the month, prior to the event for cases, or a randomly-selected month for controls, were

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that 15.8% of households identified as eligible chose not to participate in the study, average response proportions for each cell in the 2x2 tables were set to equal 84.2%. The distributions were assumed to be normal, and were truncated at 0 and one to reflect the fact that they represented response proportions. Mean values were: exposed cases = 76.2%; unexposed cases = 88.2%; exposed controls = 80.2%; unexposed controls = 92.2%. Standard deviations were set at 10% (Scenario 2) and 1.0% (Scenario 3) of each mean value.

Similar criteria were used to address case and control non-response, as well as missing data. Of the eligible cases and controls that were asked to participate, 91% and 97% participated in the case-control study. Assuming that those who did not participate were more likely to be exposed and/or injured, mean values for response proportions were set at: exposed cases = 86%; unexposed cases = 96%; exposed controls = 95%; unexposed controls = 99%. Standard deviations were again set at 10% (Scenario 2) and 1.0% (Scenario 3) of each value. For observations with missing data, it was assumed that these participants were more likely to have been exposed than not, with this tendency being stronger for cases than for controls. For "self-regulation," exposure status was unknown for seven cases and 35 controls. Thus, the range of possible cases that were exposed was 0 – 7, while the range of possible controls that were exposed was 0 – 35. Assuming triangular distributions, the likeliest values for cases and controls were 6 and 21 (Scenario 2) and 4 and 17.5 (Scenario 3).

Confounding

Confounding has been defined as any difference in observed disease frequencies between case and reference groups that are not exclusively due to differences in exposure distributions (Rothman and Greenland, 1998). Because participants in observational studies self-select into exposure groups, rather than by random assignment, cases and their comparison groups are not identical in terms of baseline demographics and/or exposures. In the counterfactual framework described by Maldonado and Greenland (2001), comparison groups are imperfect substitutes for what *would have happened* with the case group, had they had alternative exposure profiles.

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expected to have reduced the potential for recall bias or misclassification. Additionally, statistical adjustments for within-household correlation and non-response were made to further limit selection biases.

Finally, as discussed previously, given that a main intent of the RRIS–II was to serve as a surveillance effort for environmental risk factors for agricultural injury, the behavioral items measured were limited in scope and number. The 18 items were selected for inclusion based on their deemed relevance to work and safety on agricultural operations. The *a priori* constructs, based mostly on the questionnaires from which the items were adapted, were informed by exploratory factor analyses to yield the scales that were used; however, measures of internal consistency for most scales were relatively low. Low Cronbach's alphas may have been a result of the low number of items included in each scale, but might also indicate limited interpretability for the factors used.

This study explored behavior-based differential exposure to children in agricultural households and found that children's high-risk exposures are driven, at least in part, by their behavioral characteristics. This line of research can better inform educational interventions to prevent children's agricultural injury. Additionally, this work may further our etiologic understanding of children's injuries, in general, as well as children's injuries in the context of intra-familial risk.

Aim 3: Parent-Child Injury Associations

Data from Phase 1 of the RRIS–II showed that prior agricultural injury among parents was associated with risk of agricultural injury among their children (Carlson et al., 2006). These results indicated a strong intra-familial pattern of injury, which is likely to be due to specific patterns of environmental exposure, in this case on the family operation, or to common behavioral traits between parents and their children. Aim 3 of this dissertation focused on these two factors, environmental exposure and behavioral traits, as potential mediating variables in the parent-child injury associations.

Results of these analyses confirmed that parents' and children's agricultural injuries were positively associated, even while accounting for high-risk behavioral traits and agricultural work exposures. While surprising, these finding suggests that a more

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complex causal pathway, beyond that of the measured behaviors and work exposures, exists between parents' injury history and their children's risk.

Behavioral traits and work exposures were hypothesized to comprise the two major causal pathways explaining observed associations in parents' and children's injuries, based on prior research. First, given that mothers' prior injury experiences can lead to decreased injury hazards in the home (Russell and Champion, 1996), it was expected that parents' prior agricultural injuries would alter their safety-related behaviors on the farm or ranch. As children are known to model risk-taking and injury prevention behaviors after their parents, both among agricultural (DeBarr et al., 1998) as well as general population households (Darragh et al., 1998; Hu et al., 1994; White et al., 2000), enhanced safety behaviors among parents should have had preventive effects for children. Second, work exposures are also known to be shared by parents and children, and to influence injury risk. For example, Pryor et al. (2002) showed that supervision by a caregiver engaged in farm work, compared to in the home, led to increased risk of injury among children. Thus, in theory, controlling for both behavior- and exposure-related alternative pathways between parents' and children's injuries should have eliminated or reduced the observed associations.

That no mediation of parent-child injury associations was observed is not entirely inconsistent with prior studies. Other investigators have identified associations in injuries and risk-taking, even while accounting for similar covariates. For example, a large study involving a British birth cohort showed that, while controlling for demographic variables as well as aggressive behavior, a prominent risk factor for injury, children's injuries in the first five years of life predicted those in the next five years (Bijur, 1988). Further, a study of self-reported driving behavior identified strong associations between parents' and children's driving violations, even while controlling for demographic variables and hours of driving exposure (Bianchi and Summala, 2004). Across multiple studies, individual and familial injury associations have been consistent (Ferguson et al., 2001; Johnston et al., 2000; 2003; Low et al., 1996; Mistry et al., 2005; Spady et al., 2004); these associations appear to involve multiple and complex pathways that are not

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explained by behavioral or exposure factors, assessed separately, or in combination as in the current study.

It might be argued that the lack of observed mediation through high-risk behaviors and work exposures is due to risk compensation, or homeostasis, behavior. These theories purport that individuals will modify their behaviors so as to maintain a stable level of risk even in the presence of safety measures which reduce risk (O'Neill, 1977; Wilde, 1986); in this case, these theories would suggest that, even if an injured parent subsequently improves the safety of the operation environment, baseline levels of risk are met through alternative sources. However, these theories have had limited support from empirical studies of children's injuries (Pless et al., 2006). It is more likely that the current findings are due, at least in part, to a seemingly universal acceptance of injury and injury risk. Studies often show parents to believe that children's injuries are unpreventable or normative aspects of child development (Lewis et al., 2004; Morrongiello and Dayler, 1996). Not surprisingly, children of parents with who believe they have little control over injury risk are indeed more likely to be injured (Morrongiello and House, 2004).

It is also conceivable that high-risk behaviors and work exposures do explain the observed associations, but that the variables used to account for these confounders in the current study were not adequately constructed or measured. The behavioral items assessed were limited in scope and number and yielded scales with relatively low internal consistency. While low alphas may have been a result of the few items included in each scale, they might also indicate limited interpretability of the factors used. Further, farming and ranching operations are complex, and our ability to fully account for shared environmental hazards is limited. Even among household environments, routine factors such as lighting or housekeeping have been found to increase children's risk of medically attended injuries (Mott, 1999). It would be prohibitively challenging to account for all such important factors in agricultural work environments through an observational study design.

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Strengths and Limitations

Limitations, beyond those described above, should also be considered when interpreting results. For example, it may be reasoned that some families are better reporters of injuries than others, leading to misunderstanding of observed associations. However, the consistency in findings between this study and prior studies involving medical records data (Johnston et al., 2000; 2003; Mistry et al., 2005; Spady et al., 2004) indicates that intra-familial risk of injury is not solely an artifact of reporting bias. Also, due to the self-reported nature of the data, results could potentially be a result of information bias; however, the use of six-month recall periods was expected to minimize recall bias, based on results of prior validation studies (Braun et al., 1994; Gerberich et al., 1990). A particular strength of this study was the large number of participating eligible households (84%) and cases and controls (95% and 97%, respectively). While the high participation rates should adequately reduce the potential for selection bias to affect study results, an additional attempt to control such bias was made through adjustments for non-response and within-household correlation.

Despite potential limitations, the current findings add to our understanding of intra-familial injuries by examining high-risk behaviors and work exposures as potential mediators of observed parent-child injury associations. While associations between parents' past agricultural injuries and their children's risk of injury were maintained while accounting for these factors, more complex pathways, involving shared behaviors and environments, are still likely to explain this association. Despite unknown etiology, these findings indicate a need for focused interventions targeted specifically to families with injured parents. Further studies that simultaneously consider detailed social, physical, and behavioral environments will contribute substantially to this topic.

Study Validity

Observational studies are susceptible to error due to dependence on assumptions in the design, methods, and analysis phases; the non-random assignment of study subjects to exposure categories, particularly for the reference population, is a primary concern. As described by Maldonado (unpublished manuscript, 2006), the observed odds ratios, E(RR), presented in this study are the products of true odds ratios, RR_{causal} (i.e., effects

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of behavioral traits on children's risk of agricultural injury) and all error factors, such that:

$$E(RR) = RR_{causal} \bullet \frac{\alpha_{1i}\,\delta_{0i}}{\beta_{1i}\,\gamma_{0i}} \bullet \frac{\alpha_{1j}\,\delta_{0j}}{\beta_{1j}\,\gamma_{0j}} \bullet E, \text{ for } i \neq j$$

Each error factor represents a calculation of the differential associations between the sources of bias and exposure or outcome misclassification; two theoretical error factors are identified in the above equation. Simple algebra allows the calculation of the true causal effect of the exposures of interest (i.e., children's behavioral traits) on the outcome (i.e., children's agricultural injuries), under the condition of specified values for all error factors:

$$RR_{causal} \bullet E = \frac{E(RR)}{\frac{\alpha_{1i}\,\delta_{0i}}{\beta_{1i}\,\gamma_{0i}} \bullet \frac{\alpha_{1j}\,\delta_{0j}}{\beta_{1j}\,\gamma_{0j}}} \text{ for } i \neq j$$

Assuming no other issues of validity, then, the estimated odds ratios from each study are the products of true odds ratios and *all* error factors (confounding, measurement error, selection bias, specification bias, and random error):

$$RR_{causal} = E(RR) / (E_{confounding} \bullet E_{measurement} \bullet E_{selection} \bullet E_{specification} \bullet E_{random})$$

For the current study, Monte Carlo simulations were performed in order to forecast the product of the error factors and, then, the potential distributions of true odds ratios for each independent variable. Crystal Ball Risk Analysis Software was used for these analyses (Decisioneering, 1998). Since the magnitude and distribution of each error factor ("priors") had to be specified, yet were unknown, analyses were run using three different scenarios for comparison: (1) under the assumption that the product of all study errors equaled one (the default value when uncertainty analyses are not performed); (2) under the assumption that *limited* data pertinent to validity (i.e., from validity sub-studies) were available for extrapolation to uncertainty analyses – hence, possible distributions for each prior were relatively wide; and, (3) under the assumption that *comprehensive* data pertinent to validity were available for extrapolation, resulting in the use of narrower distributions, or less differential response, between exposed and unexposed participants.

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The ranges and distributions of study errors ("priors") were estimated based on plausible assumptions of the differential effect of each bias source on the observed case and reference groups. The most salient of these potential sources of bias, and the assumptions made for purposes of the uncertainty analyses, are described below.

Information Bias

An important consideration in this study is the potential for measurement error. Measurement error has been described as a serious threat to the validity of epidemiologic studies as it can produce a large amount of bias (Maldonado, 1993; Greenland, 1990; Copeland et al., 1977; Dosemeci et al., 1990; Gilbert, 1991; Flegal et al., 1991; Wacholder et al., 1991). It is anticipated that there was some level of measurement error in the reporting of both injury events and behavioral and environmental exposures pertinent to these events; this problem was addressed in several ways in the study design. First, potential errors in the reporting of injury and relevant exposures were minimized through use of a six-month recall period (Gerberich et al., 1990; Braun et al., 1994), careful development, modification, and testing of the CATI instrument, and comprehensive interviewer training. Second, a validation sub-study was conducted to help estimate the degree of measurement error due to self-reporting of physical injuries and their consequences. In addition, a reliability sub-study was conducted to determine the degree of reproducibility in responses (Kelsey et al., 1996). The validation and reliability sub-studies are described in detail in Chapter 3 of this thesis.

For purposes of the uncertainty analyses, recall bias was assumed to be the most important source of measurement error in this study, given the self-reported nature of exposure and outcome data. It was hypothesized that families with children who had been injured would be more likely to report undesirable behaviors than families with children who had not sustained injuries. Thus, values for correct recall were estimated using (100 – frequency of each high-risk behavior) as the baseline mean value, and allowing these values to vary for each cell in respective 2x2 tables. Normal distributions with standard deviations of 10% (Scenario 2) or 1% (Scenario 3) of each value were also assumed.

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Selection Bias

The efficiency of the case-control design results from studying only a sample of the cohort at risk (Greenland, 1994). With the increased efficiency, however, comes the potential for selection bias due to the way in which subjects are sampled into the study. Selection bias can occur if: (1) the cases in the study are a biased sample of the cases in the study population during the study period; or (2) the controls in the study are a biased sample of the population at risk during the study period. Potential selection bias was addressed in the analysis of study data by inversely weighting observed responses with probabilities of response (Horvitz and Thompson, 1952), estimated as a function of the following characteristics available from the NASS Master List Frame: state in which the operation was located; type of operation; and operation revenue, by quintile. To account for unknown eligibility among non-respondents, probability of eligibility was estimated for these same characteristics (Mongin, 2001). Further, agricultural households that refused to participate in the full interview, or who were not successfully contacted after an exhaustive contact protocol was completed, were mailed an abbreviated survey requesting limited information to assess the differential impact of non-response on study results.

Similar to measurement error, selection biases were taken into account in probabilistic uncertainty analyses by estimating the simultaneous effects of sampling bias, losses to follow-up, case and control non-response, and missing data. Sampling bias, introduced when those identified as eligible are not randomly sampled, was addressed by assuming normal distributions of bias for each cell in the respective 2x2 tables, and centering these distributions at one (which would assume no sampling error). Standard deviations were set at 0.10 (Scenario 2) and 0.01 (Scenario 3). Data on eligible households who declined to participate were used to consider the effects of losses to follow-up. In general, it was assumed that those who were lost to attrition were more likely to: (1) have undesirable behavioral traits, and (2) have been injured. This was based on an assumption that non-respondents were more sensitized to behavioral or child labor issues, or, that these families were too busy to participate, indicating increased possibility of hazardous exposures (and thus more frequent injuries) to children. Given

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For example, observed associations between parents and children's injuries may have been confounded by several different background variables. For example, parents' work hours off of the agricultural operation, or environmental exposures beyond those that were included in the analyses, may have influenced both parents' and children's risks of injury. For the current study, causal models were used to specify potential confounders for inclusion in the multivariable models for each analysis. While these methods helped to ensure the most appropriate specification of variables for inclusion in the models (Greenland et al., 1999), the relationships between causal model variables were based primarily on assumptions made by study investigators. As such, it is possible that residual confounding due to unidentified or unmeasured confounding variables such as those mentioned above, or incorrect specification of the associations between variables, could have affected results of the current study.

Given that the statistical adjustments for confounding were unlikely to control all demographic and/or exposure differences between the case and control children, an assessment of the potential effects of residual confounding were incorporated into the uncertainty analyses. To address this potential source of error, values for residual confounding were centered at one (which would assume no confounding), but allowed to vary by 10% (Scenario 2), or 1.0% percent (Scenario 3), assuming uniform distributions.

Specification Bias

Specification bias results from the incorrect specification of the sampling model or structural model. This study primarily used logistic regression for data analyses, which assumes sampling from a binomial distribution and a multiplicative structural model. If these assumptions were not met, the study results may be invalid.

Quantitative analysis of potential specification bias is difficult, as the underlying distributions of key variables within study populations are rarely understood. Similar to the methods used to account for confounding-related error factors, effects of potential specification bias were assumed to vary across cells in respective 2x2 tables. Thus, normal distributions with mean values set at one (which would assume no bias) were specified, but with standard deviations of 0.10 (Scenario 2) and 0.01 (Scenario 3).

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Uncertainty Analyses

Results of the uncertainty analyses were informative in terms of the robustness of each measure of association in the present study. Select results of the uncertainty analyses performed as part of this study are presented in **Table 1**. As the observed mean values, and ranges of possible mean values, were highly dependent on the assumptions about each potential source of error and its effect on study results ("priors"), these assumptions are presented in **Figure 1**. Resulting distributions of the possible mean odds ratios are also included in Figure 1.

In general, the magnitude and direction of effect of most associations of interest were largely unchanged when accounting for these potential sources of study error. However, while mean ORs tended to be farther from the null than the adjusted, multivariable ORs identified in the results for each aim, the distributions of possible ORs for most exposures of interest included the null value of one. Given that there were limited data on which the specified priors could be based, these analyses essentially substituted an alternative set of assumptions (the priors) for the major assumption made by investigators when quantitative assessments of study error are not performed (that the product of all error factors equals one).

The results of this simple simulation exercise did not alter the interpretations of study results; however, they do call into consideration the susceptibility of estimated causal parameters to study error. On the other hand, these ranges were mostly based on subjective priors specifying the possible effects of differential bias on each exposure category. Therefore, caution should be taken in the interpretation of these results until more detailed information on study error is available for incorporation into uncertainty analyses.

Conclusions

Despite potential limitations due to error factors, this study contributes important information to the fields of agricultural safety and health, developmental psychology, and injury epidemiology. Important behavioral traits were identified as contributing to children's high-risk work and environmental exposures and their overall risk of agricultural injury. Further, while associations between parents' past agricultural injuries

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and their children's risk of injury were maintained while accounting for behavioral and environmental factors, these findings indicated a need to consider more complex causal pathways in the modeling of children's injuries. Findings from this study also suggest a need for focused interventions tailored to address specific behavior-related risk factors, and targeted specifically at the family level, particularly among those with injured parents. Further research should consider the roles of social, physical, and behavioral environments, simultaneously, in intra-familial risks of injury.

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REFERENCES

Barkley RA, Guevremont DC, Anastopoulos AD, DuPaul GJ, Shelton TJ: Driving-related risks and outcomes of attention deficit hyperactivity disorder in adolescents and young adults: A 3- to 5-year follow up survey. *Pediatrics*, 92: 212-218, 1993.

Bianchi A, Summala H: The "genetics" of driving behavior: Parents' driving style predicts their children's driving style. *Accident Analysis and Prevention*, 36: 655-659, 2004.

Bijur PE, Golding J, Haslum M: Persistence of occurrence of injury: Can injuries of preschool children predict injuries of school-aged children? *Pediatrics*, 82(5): 707-712, 1988.

Bijur PE, Stewart-Brown S, Butler N: Child behavior and accidental injury in 11,966 preschool children. *American Journal of Diseases of Children*, 140: 487-492, 1986.

Boyle D, Gerberich SG, Gibson RW, Maldonado G, Robinson A, Martin F, Renier CM: Case-control study of dairy-operation related injuries: Rate ratios associated with dairy activities. *Epidemiology*, 8: 37-41, 1997.

Braun BL, Gerberich SG, Sidney S: Injury events: Utility of self-report in retrospective identification in the USA. *Journal of Epidemiology and Community Health*, 49: 604-605, 1994.

Brison RJ, Pickett W, Berg RL, Linneman J, Zentner J, Marlenga B: Fatal agricultural injuries in preschool children: Risks, injury patterns and strategies for prevention. *Canadian Medical Association Journal*, 174(12): 1723-1726, 2006.

Carlson KF, Langner DM, Alexander BH, Gurney J, Gerberich SG, Ryan AD, Renier CM, Mongin SJ: The association between parent and child agricultural injuries in the Regional Rural Injury Study – II. *Archives of Pediatrics and Adolescent Medicine*; In Press, 2006.

Caspi A, Silva PA: Temperamental qualities at age three predict personality traits in young adulthood: Longitudinal evidence from a birth cohort. *Child Development*, 66(2): 486-498, 1995.

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Chliaoutakis JE, Demakakos P, Tzamalouka G, Bakou V, Koumaki M, Darviri C: Aggressive behavior whie driving as predictor of self-reported car crashes. *Journal of Safety Research*, 33: 431-443, 2002.

Copeland KT, Checkoway H, McMichael AJ, Holbrook RH: Bias due to misclassification in the estimation of relative risk. *American Journal of Epidemiology*, 5: 488-495, 1977.

Darragh AR, Stallones L, Sample PL, Sweitzer K: Perceptions of farm hazards and personal safety behavior among adolescent farmworkers. *Journal of Agricultural Safety and Health Special Issue*, 1: 159-169, 1998.

Davidson LL: Hyperactivity, antisocial behavior, and childhood injury: A critical analysis of the literature. *Developmental and Behavioral Pediatrics*, 8(6): 335-340, 1987.

Davidson LL: Hyperactivity in school-age boys and subsequent risk of injury. *Pediatrics*, 90(5): 697-702, 1992.

Davidson LL, Hughes SJ, O'Connor PA: Preschool behavior problems and subsequent risk of injury. *Pediatrics*, 82(4): 644-651, 1998.

DeBarr KA, Ritzel DO, Wright WR, Kittleson MJ: Friends and family: Implications for youth tractor safety. *Journal of Safety Research*, 29(2): 87-95, 1998.

Decisioneering: *Crystal Ball Users Manual 2000.2.* Denver, CO: Decisioneering, Inc., 1998.

Deković M, Noom MJ, Meeus W: Expectations regarding development during adolescence: Parental and Adolescent Perceptions. *Journal of Youth and Adolescence*, 26(3): 1997.

DeRoo LA, Rautiainen RH: A systematic review of farm safety interventions. *American Journal of Preventive Medicine*, 18(4 Suppl): 51-62, 2000.

Dimich-Ward H, Guernsey JR, Pickett W, Rennie D, Hartling L, Brison RL: Gender differences in the occurrence of farm related injuries. *Occupational and Environmental Medicine*, 61(1): 52-56, 2004.

Dosemeci M, Wacholder L, Lubin JH: Does nondifferential misclassification of exposure always bias a true effect toward the null value? *American Journal of Epidemiology*, 132: 746-748, 1990.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Elkington JM: *A Case-control study of farmwork related injuries in Olmsted County, Minnesota.* Doctoral Thesis. Minneapolis: University of Minnesota, 1990.

Farmer JE, Peterson L: Injury risk factors in children with attention deficit hyperactivity disorder. *Health Psychology*, 14(4): 325-332, 1995.

Ferguson SA, Williams AF, Chapline JF, Reinfurt DW, De Leonardis DM: Relationship of parent driving records to the driving records of their children. *Accident Analysis and Prevention*, 33(2): 229-234, 2001.

Flegal KM, Keyl PM, Nieto FJ: Differential misclassification arising from nondifferential errors in exposure measurement. *American Journal of Epidemiology*, 134: 1233-1244, 1991.

Fraser CE, Smith KB, Judd F, Humphreys JS, Fragar LJ, Henderson A: Farming and mental health problems and mental illness. *International Journal of Social Psychiatry*, 51(4): 340-349, 2005.

Friedman HS: Long-term relations of personality and health: Dynamisms, mechanisms, tropisms. *Journal of Personality*, 68(6): 1089, 2000.

Frone MR: Predictors of work injuries among employed adolescents. *Journal of Applied Psychology*, 83(4): 565-576, 1998.

Gerberich SG, Gibson RW, Gunderson PD, French LR, Melton LJ III, Erdman A, Smith P, True JA, Carr WP, Elkington J, Renier CM, Andreasson LR. *The Olmsted Agricultural Trauma Study (OATS): A population-based effort.* Report to the Centers for Disease Control, 1991.

Gerberich SG, Gibson RW, French LD, Carr P, Renier CM, Gunderson P, Martin F, True J, Shutske J, Brademeyer K. *The Regional Rural Injury Study – I (RRIS–I): A population-based effort.* A Report to the Centers for Disease Control, 1993.

Gerberich SG, Gibson RW, French LR, Lee T-Y, Carr WP, Kochevar L, Renier CM, Shutske J: Machinery-related injuries: Regional Rural Injury Study – I (RRIS–I). *Accident Analysis and Prevention*, 30(6): 793-804, 1998.

Gerberich SG, Gibson RW, French LR, Church TR, Alexander BH, Shutske J, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR, Zhang X, Jensen KE: *Etiology and consequences of injuries among children in farm households: A regional rural*

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injury study. A report to the Centers for Disease Control and Prevention. Minneapolis: Regional Injury Prevention Center, University of Minnesota, 2003.

Gerberich SG, Gibson RW, French LR, Renier CM, Lee T-Y, Carr WP, Shutske J: Injuries among farm children and youth in farm households: Regional Rural Injury Study – I (RRIS–I). *Injury Prevention*, 7: 117-122, 2001.

Gerberich SG, Gibson RW, Gunderson PW, Melton LJ III, French LR, Renier CM, Erdman AG, True JA, Carr WP, Elkington JM: Validity of trauma reporting in the agricultural community. *Journal of Occupational Accidents*, 12: 200, 1990.

Gerberich SG, Alexander BH, Church TR, Masten AS, Renier CM, Mongin SJ, Ryan A, Ferguson KR: *Regional Rural Injury Study – II, Phase 2: Agricultural Injury Surveillance.* A report to the Centers for Disease Control and Prevention. Minneapolis: Regional Injury Prevention Center, University of Minnesota, 2004.

Gilbert ES: Does nondifferential misclassification of exposure always bias a true effect toward the null value? *American Journal of Epidemiology*, 134: 440-441, 1991.

Goldcamp M, Hendricks KJ, Myers JR: Farm fatalities to youth 1995-2000: A comparison by age groups. *Journal of Safety Research*, 35: 151-157, 2004.

Greenland S: Randomization, statistics, and causal inference. *Epidemiology*, 1: 421-429, 1990.

Greenland S: *Validity concepts in epidemiologic research.* UCLA Department of Epidemiology technical report, 1994.

Hansen CP: A causal model of the relationship among accidents, biodata, personality and cognitive factors. *Journal of Applied Psychology*, 74(1): 81-90, 1989.

Hartling L, Brison RJ, Crumley ET, Klassen TP, Pickett W: A systematic review of interventions to prevent childhood farm injuries. *Pediatrics*, 114(4):e483-496, 2004.

Hendricks KJ, Goldcamp EM, Myers JR: On-farm falls among youth less than 20 years old in the U.S. *Journal of Agricultural Safety and Health*, 10(1): 27-38, 2004.

Horvitz DG, Thompson DJ: A generalization of sampling without replacement from a finite universe. *Journal of the American Statistical Association*, 47(260): 663-685, 1952.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Hu X, Wesson DF, Parlin PC, Chipman ML, Spence LJ: Current bicycle helmet ownership, use, and related factors among shool-aged children in metropolitan Toronto. *Canadian Journal of Public Health*, 85: 121-124, 1994.

Jaquess DL, Finney JW: Previous injuries and behavior problems predict children's injuries. *Journal of Pediatric Psychology*, 19(1): 79-89, 1994.

Johnston BD, Grossman DC, Thompson RS: Transient elevation in risk of injury in siblings following injury encounters. *Journal of Pediatrics*, 142(1): 79-83, 2003.

Johnston BD, Grossman DC, Connell FA, Koepsell TD: High-risk periods for childhood injury among siblings. *Pediatrics*, 105(3part1): 562-568, 2000.

Kelsey JL, Whittemore AS, Evans AS, Thompson WD: *Methods in observational epidemiology. Second Edition*, New York: Oxford University Press, 1996.

Kelsey TW: The agrarian myth and policy responses to farm safety. *American Journal of Public Health*, 84(7): 1171-1177, 1994.

Keogh JP, Nuwayhid I, Gordon JL, Gucer PW. The impact of occupational injury on injured worker and family: outcomes of upper extremity cumulative trauma disorders in Maryland workers. *American Journal of Industrial Medicine*, 38: 498-506, 2000.

Kim J, Zepeda L: Time allocation by fathers, mothers and children in U.S. family farm households: A bargaining approach. Feminist Economics, 10(1): 115-139, 2004a.

Kim J, Zepeda L: Factors affecting children's participation and amount of labor on family farms. *Journal of Safety Research*, 35(4): 391-401, 2004b.

Lam LT, Yang L, Zheng Y, Ruan C, Lei Zhenlain: Attention deficit and hyperactivity disorder tendency and unintentional injury among adolescents in China. *Accident Analysis and Prevention*, in press, 2006.

Langley J, McGee R, Silva P, Williams S: Child behavior and accidents. *Journal of Pediatric Psychology*, 8(2): 181-189, 1983.

Lee BC, Jenkins LS, Westaby JD: Factors influencing exposure of children to major hazards on family farms. *Journal of Rural Health*, 13(3) 206-215, 1997.

Lewis TL, DiLillo D, Peterson L: Parental beliefs about the developmental benefits of unintentional childhood injuries. *American Journal of Health Behavior*, 28: 861-868, 2004.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Linn JG, Husaini BA: Determinants of psychological depression and coping behaviors of Tennessee farm residents. *Journal of Community Psychology*, 15(4): 503-512, 1987.

Low JM, Griffith GR, Alston CL: Australian farm work injuries: Incidence, diversity and personal risk factors. *Australian Journal of Rural Health*, 4(3): 179-89, 1996.

Maldonado G: Interpreting epidemiologic studies. In: *Environmental Epidemiology.* Advances in Chemistry Series, Draper W., Editor, No. 241, American Chemical Society Books, 1993.

Maldonado G: Adjusting a relative-risk estimate for study imperfections. Unpublished Manuscript, 2006.

Manheimer DI, Mellinger GD: Personality characteristics of the child accident repeater. *Child Development*, 38(2): 491-513, 1967.

Mason C, Earle-Richardson G: New York state child agricultural injuries: How often is maturity a potential contributing factor? *American Journal of Industrial Medicine Supplement*, 2: 36-42, 2002.

Matheny AP, Brown AM, Wilson RS: Behavioral antecedents of accidental injuries in early childhood: A study of twins. *The Journal of Pediatrics*, 79(1): 122-124, 1971.

McGwin G Jr, Scotten S, Aranas A, Enochs R, Roseman JM: The impact of agricultural injury on farm owners and workers in Alabama and Mississippi. *American Journal of Industrial Medicine*, 37(4): 374-381, 2000.

Mistry RD, Hoffmann RG, Yauck JS, Brousseau DC: Association between parental and childhood emergency department utilization. *Pediatrics*, 115(2): e147-e151, 2005.

Mongin SJ: *Adjustment for non-response in the Minnesota Nurses Study.* Health Studies Research Report (http://www1.umn.edu/eoh/NewFiles/resreports.html). Division of Environmental Health Sciences, University of Minnesota, Minneapolis, Minnesota, 2001.

Morrongiello BA, Dayler L: A community-based study of parents' knowledge, attitudes and beliefs related to childhood injuries. *Canadian Journal of Public Health*, 87(6): 383-388, 1996.

Morrongiello BA, House K: Measuring parent attributes and supervision behaviors relevant to child injury risk: Examining the usefulness of questionnaire measures.

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Injury Prevention, 10(2): 114-118, 2004.

Mott JA: Personal and family predictors of children' medically attended injuries that occurred in the home. *Injury Prevention*, 5: 189-193, 1999.

Norris FH, Matthews BA, Riad JK: Characterological, situational, and behavioral risk factors for motor vehicle accidents: A prospective examination. *Accident Analysis and Prevention*, 32(4): 505-515, 2000.

O'Neill B: A decision-theory model of danger compensation. *Accident Analysis and Prevention*, 9: 157-165, 1977.

Peele PB, Tollerud DJ: Depression and occupational injury: Results of a pilot investigation. *Journal of Occupational and Environmental Medicine*, 47(4): 424-427, 2005.

Pickett W, Hartling L, Brison RJ, Guernsey JR: Fatal work-related farm injuries in Canada, 1991-1995. Canadian Agricultural Injury Surveillance Program. *Canadian Medical Association Journal*, 160(13): 1843-1848, 1999.

Pickett W, Marlenga B, Berg RL: Parental knowledge of child development and the assignment of tractor work to children. *Pediatrics*, 112(1 Pt 1): e11-e16, 2003.

Pless IB, Magdalinos H, Hagel B: Risk-compensation behavior in children: Myth or reality? *Archives of Pediatrics and Adolescent Medicine*, 160(6): 610-614, 2006.

Pratt DS, Marvel LH, Darrow D, Stallones L, May JJ, Jenkins PL: The dangers of dairy farming: The injury experience of 600 workers followed for two years. *American Journal of Industrial Medicine*, 21(5): 637-50, 1992.

Pryor SK, Caruth AK, McCoy CA: Children's injuries in agriculture related events: the effect of supervision on the injury experience. *Issues in Comprehensive Pediatric Nursing*, 25: 189-205, 2002.

Pulkkinen L: Behavioral precursors to accidents and resulting physical impairment. *Child Development*, 66: 1660-1679, 1995.

Rivara FP, Howard D: Parental knowledge of child development and injury risks. *Developmental and Behavioral Pediatrics*, 3(2): 103-105, 1982.

Rothman KJ, Greenland S: *Modern Epidemiology, Second Edition*. Philadelphia: Lippincott-Raven, 1998.

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Rowe R, Maughan B, Goodman R: Childhood psychiatric disorder and unintentional injury: Findings from a national cohort study. *Journal of Pediatric Psychology*, 29(2): 119-130, 2004.

Russell KM, Champion VL: Health beliefs and social influence in home safety practices of mothers with preschool children. *Image: Journal of Nursing Scholarship*, 28(1): 59-64, 1996.

Ryb GE, Dischinger PC, Kufera J, Read KM: Risk perception and impulsivity: Association with risky behaviors and substance abuse disorders. *Accident Analysis and Prevention*, 38(3): 567-573, 2006.

Scarth R, Stallones L, Zwerling C, Burmeister L: The prevalence of depressive symptoms and risk factors among Iowa and Colorado farmers. *American Journal of Industrial Medicine*, 37(4): 382-389, 2000.

Schwebel DC: The role of impulsivity in children's estimation of physical ability: Implications for children's unintentional injury risk. *American Journal of Orthopsychiatry*, 74(4): 584-588, 2004.

Schwebel DC, Hodgens JB, Sterling S: How mothers parent their children with behavior disorders: Implications for unintentional injury risk. *Journal of Safety Research*, 37: 167-173, 2006.

Schwebel DC, Plumert JM: Longitudinal and concurrent relations among temperament, ability estimation, and injury proneness. *Child Development*, 70(3): 700-712, 1999.

Spady DW, Saunders DL, Schopflocher DP, Svenson LW: Patterns of injury in children: A population-based approach. *Pediatrics*, 113(3): 522-529, 2004.

Stallones L, Leff M, Garrett C, Criswell L, Gillan T: Depressive symptoms among Colorado farmers. *Journal of Agricultural Safety and Health*, 1(1): 37-43, 1995.

Steinberg L: Risk taking in adolescence: What changes, and why? *Annals of the New York Academy of Sciences*, 1021: 51-58, 2004.

Stueland DT, Nordstrom DL, Layde PM, Follen MA, Olson KA, Brand LM, Gunderson PD: Case control study of agricultural injuries to older farmers in central Wisconsin. *Journal of the American Geriatric Society*, 44(4): 475-476, 1996.

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Stueland DR, Lee BC, Nordstrom DL, Layde PM, Wittman LM, Gunderson PD: Case-control study of agricultural injuries to women in central Wisconsin. *Women and Health*, 25(4): 91-103, 1997.

Sutherland VJ, Cooper CL: Personality, stress, and accident involvement in the offshore oil and gas industry. *Personality and Individual Differences*, 12: 195-204, 1991.

Tiesman HM, Peek-Asa C, Whitten P, Sprince NL, Stromquist A, Zwerling C: Depressive symptoms as a risk factor for unintentional injury: A cohort study in a rural county. *Injury Prevention*, 12: 172-177, 2006.

Vose D: *Risk Analysis. A Quantitative Guide (2nd Edition)*. New York, NY: John Wiley & Sons, LTD, 2000.

Wacholder S, Dosemeci M, Lubin JH: Blind assignment of exposure does not always prevent differential misclassification. *American Journal of Epidemiology*, 134: 433-437, 1991.

Wazana A: Are there injury-prone children? A critical review of the literature. *Canadian Journal of Psychiatry*, 42(6): 602-610, 1997.

White HR, Johnson V, Buyske S: Parental modeling and parenting behavior effects on offspring alcohol and cigarette use – a growth curve analysis. *Journal of Substance Abuse*, 12: 287-210, 2000.

Wilde GJS: Beyond the concept of risk homeostasis: Suggestions for research and application towards the prevention of accidents and lifestyle-related disease. *Accident Analysis and Prevention*, 18: 377-401, 1986.

Wilk VA: Health hazards to children in agriculture. *American Journal of Industrial Medicine*, 24: 283-290, 1993.

Zebrowitz LA, Kendall-Tackett K, Fafel J: The influence of children's facial maturity on parental expectations and punishments. *Journal of Experimental Child Psychology*, 52(2): 221-238, 1991.

Zuckerman M, Kuhlman DM: Personality and risk-taking: Common biosocial factors. *Journal of Personality*, 68(6): 999-1029, 2000.

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TABLE 1

Results of Select Uncertainty Analyses under Scenario 1, Scenario 2, and Scenario 3: Regional Rural Injury Study – II (RRIS-II)

Exposure of Interest	Outcome of Interest	Scenario 1*	Scenario 2†		Scenario 3‡	
		RR_{causal}	RR_{causal}	Range	RR_{causal}	Range
High vs. Low Depressive Symptoms	Children's Injury	2.0	2.3	0.5 – 7.5	2.1	1.3 – 3.3
Low vs. High Self-Regulation	Children's Injury	0.4	0.4	0.3 – 0.6	0.4	0.2 – 0.7
Low vs. High Careful/Cautious Behavior	Children's Injury	1.9	2.3	0.5 – 7.3	2.0	1.2 – 3.4
High vs. Med/Low Depressive Symptoms	Worked with Dairy Cattle	2.7	3.5	1.0 – 12.4	2.9	1.7 – 5.1
High vs. Med/Low Aggression	Rode on Tractors	1.7	2.2	0.6 – 6.8	1.8	1.0 – 3.0
Low vs. Med/High Self-Regulation	Operated Tractors	0.5	0.6	0.1 – 2.0	0.5	0.3 – 0.9
Father Injured Prior to Study vs. Not	Children's Injury	1.9	2.6	0.5 – 12.8	2.1	1.1 – 3.7
Mother Injured Prior to Study vs. Not	Children's Injury	2.1	3.5	0.6 – 13.5	2.5	1.0 – 5.0

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Both Parents Injured Prior to Study vs. Neither Ever Injured	Children's Injury	3.1	4.9	0.6 – 18.9	4.0	1.6 – 8.9

* Scenario 1: Assuming the sum of all error factors = 1.0 (point distribution – no range of estimates possible)

† Scenario 2: Assuming limited data pertinent to validity (i.e., from validity sub-studies) are available for extrapolation to uncertainty analyses; thus, possible distributions for each prior are relatively wide.

‡ Scenario 3: Assuming good data pertinent to validity are available for extrapolation to uncertainty analyses

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FIGURE 1: PRIORS AND RESULTING DISTRIBUTIONS OF RR_{CAUSAL} ESTIMATES

Regional Rural Injury Study – II (RRIS-II)

A. High vs. Low Depressive Symptoms and Children's Risk of Injury

Scenario 2 Priors:

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.92; exposed controls = 0.84;

unexposed cases = 0.84; unexposed controls = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

Missing Data: Triangular Distributions

cases: range = 0 – 7; likeliest value = 6

controls: range = 0 – 36; likeliest value = 22

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 2.3; Range = 0.5 – 7.5

Scenario 3 Priors:

Uniform Distribution; Range = 0.99 – 1.01

Normal Distribution; 1.0% Standard Deviation (SD)

exposed cases = 0.92; exposed controls = 0.84;

unexposed cases = 0.84; unexposed controls = 0.90

Normal Distributions; 1.0% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Normal Distributions; 1.0% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

Triangular Distributions

cases: range = 0 – 7; likeliest value = 4

controls: range = 0 – 36; likeliest value = 18

Normal Distribution; Mean = 1.0; 1.0% SD

Mean = 2.1; Range = 1.3 – 3.3

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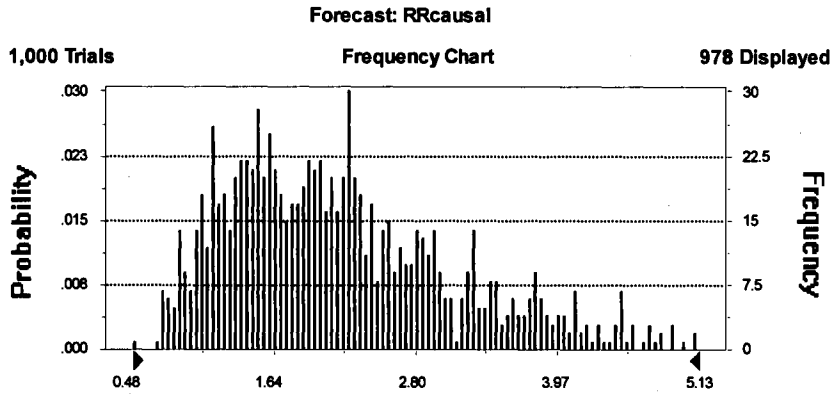

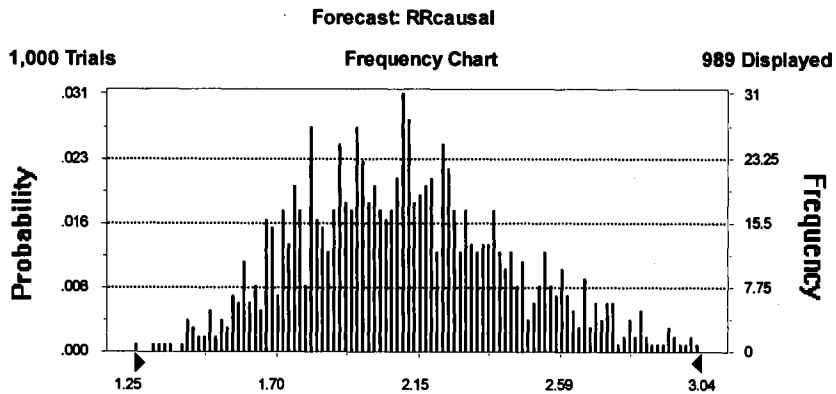

B. Low vs. High Self-Regulation and Children's Risk of Injury

Scenario 2 Priors:

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.92; exposed controls = 0.84;

unexposed cases = 0.84; unexposed controls = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD

Scenario 3 Priors:

Uniform Distribution; Range = 0.99 – 1.01

Normal Distribution; 1.0% Standard Deviation (SD)

exposed cases = 0.92; exposed controls = 0.84;

unexposed cases = 0.84; unexposed controls = 0.90

Normal Distributions; 1.0% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Normal Distributions; 1.0% SD

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exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

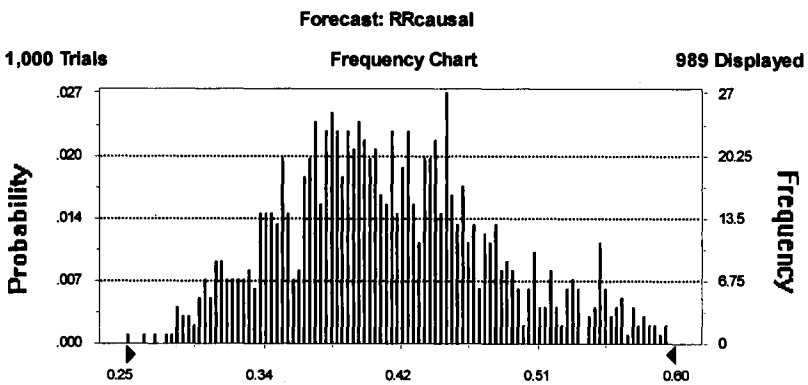
Missing Data: Triangular Distributions

cases: range = 0 – 7; likeliest value = 6

controls: range = 0 – 35; likeliest value = 21

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 0.4; Range = 0.3 – 0.6



exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

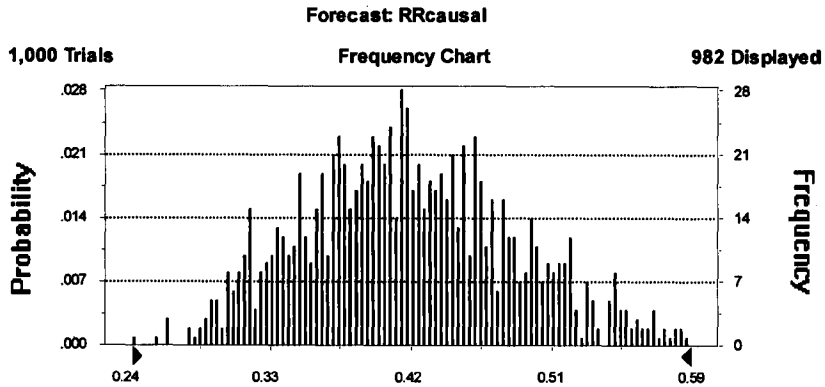
Triangular Distributions

cases: range = 0 – 7; likeliest value = 4

controls: range = 0 – 36; likeliest value = 17.5

Normal Distribution; Mean = 1.0; 1.0% SD

Mean = 0.4; Range = 0.2 – 0.7



C. Low vs. High Careful/Cautious Behavior and Children's Risk of Injury

Scenario 2 Priors:

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

Scenario 3 Priors:

Uniform Distribution; Range = 0.99 – 1.01

Normal Distribution; 1.0% Standard Deviation (SD)

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exposed cases = 0.86; exposed controls = 0.80;
unexposed cases = 0.88; unexposed controls = 0.82

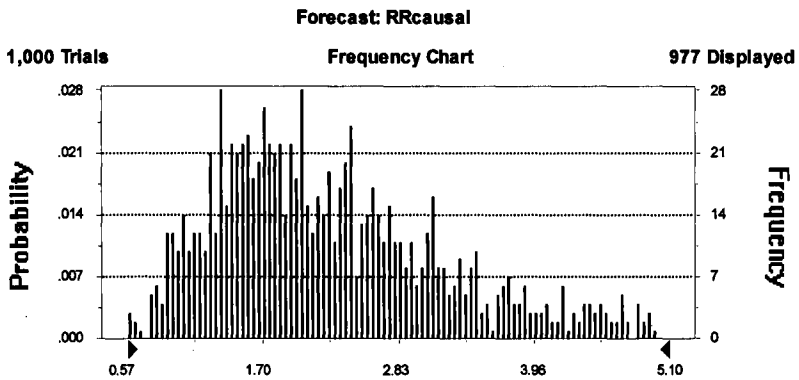
Losses to Follow-Up: Normal Distributions; 10% SD
exposed cases = 0.76; exposed controls = 0.80
unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD
exposed cases = 0.86; exposed controls = 0.95
unexposed cases = 0.96; unexposed controls = 0.99

Missing Data: Triangular Distributions
cases: range = 0 – 7; likeliest value = 6
controls: range = 0 – 36; likeliest value = 22

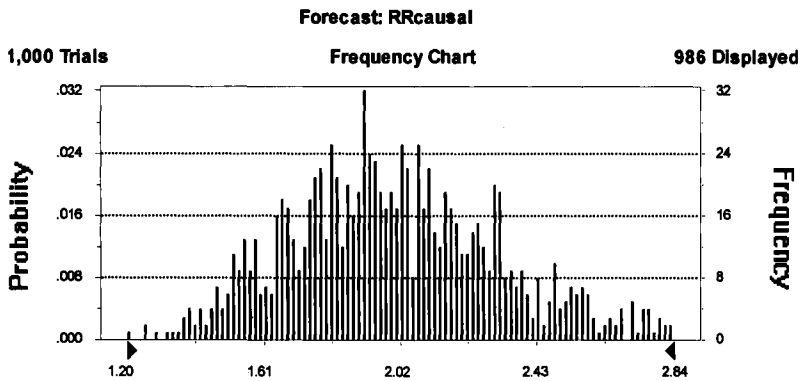
Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 2.3; Range = 0.5 – 7.3



exposed cases = 0.86; exposed controls = 0.80;
unexposed cases = 0.88; unexposed controls = 0.82
Normal Distributions; 1.0% SD
exposed cases = 0.76; exposed controls = 0.80
unexposed cases = 0.88; unexposed controls = 0.92
Normal Distributions; 1.0% SD
exposed cases = 0.86; exposed controls = 0.95
unexposed cases = 0.96; unexposed controls = 0.99
Triangular Distributions
cases: range = 0 – 7; likeliest value = 4
controls: range = 0 – 36; likeliest value = 18
Normal Distribution; Mean = 1.0; 1.0% SD

Mean = 2.0; Range = 1.2 – 3.4



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D. High vs. Medium/Low Depressive Symptoms and Likelihood of Working with Dairy Cattle

Scenario 2 Priors:

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.92; exposed non-cases = 0.84;

unexposed cases = 0.84; unexposed non-cases = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed non-cases = 0.80

unexposed cases = 0.88; unexposed non-cases = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed non-cases = 0.95

unexposed cases = 0.96; unexposed non-cases = 0.99

Missing Data: Triangular Distributions

cases: range = 0 – 7; likeliest value = 6

controls: range = 0 – 36; likeliest value = 22

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 3.5; Range = 1.0 – 12.4

Scenario 3 Priors:

Uniform Distribution; Range = 0.99 – 1.01

Normal Distribution; 1.0% Standard Deviation (SD)

exposed cases = 0.92; exposed non-cases = 0.84;

unexposed cases = 0.84; unexposed non-cases = 0.90

Normal Distributions; 1.0% SD

exposed cases = 0.76; exposed non-cases = 0.80

unexposed cases = 0.88; unexposed non-cases = 0.92

Normal Distributions; 1.0% SD

exposed cases = 0.86; exposed non-cases = 0.95

unexposed cases = 0.96; unexposed non-cases = 0.99

Triangular Distributions

cases: range = 0 – 7; likeliest value = 4

controls: range = 0 – 36; likeliest value = 18

Normal Distribution; Mean = 1.0; 1.0% SD

Mean = 2.9; Range = 1.7 – 5.1

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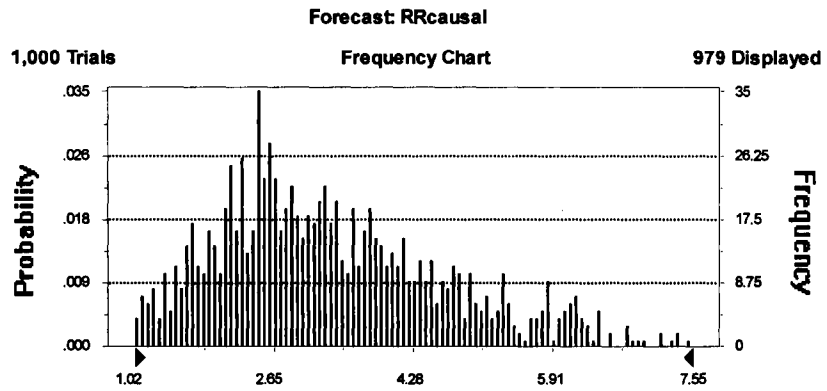

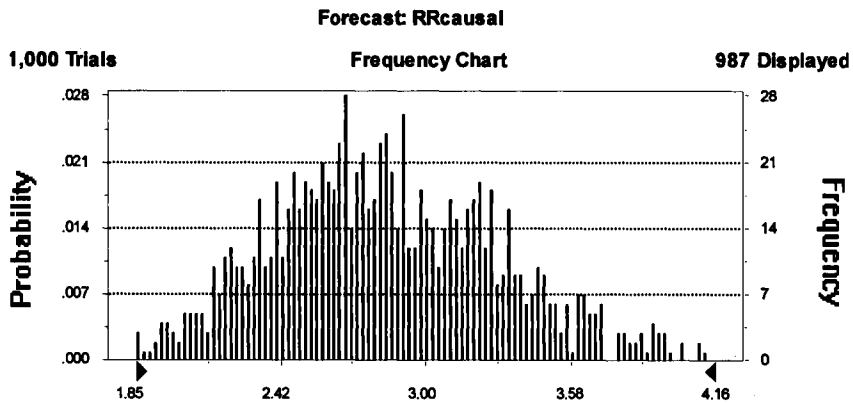

E. High vs. Low Aggression and Likelihood of Riding on Tractors

Scenario 2 Priors:

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.96; exposed non-cases = 0.90;

unexposed cases = 0.98 unexposed non-cases = 0.92

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed non-cases = 0.80

unexposed cases = 0.88; unexposed non-cases = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed non-cases = 0.95

unexposed cases = 0.96; unexposed non-cases = 0.99

Scenario 3 Priors:

Uniform Distribution; Range = 0.99 – 1.01

Normal Distribution; 1.0% Standard Deviation (SD)

exposed cases = 0.96; exposed non-cases = 0.90;

unexposed cases = 0.98; unexposed non-cases = 0.92

Normal Distributions; 1.0% SD

exposed cases = 0.76; exposed non-cases = 0.80

unexposed cases = 0.88; unexposed non-cases = 0.92

Normal Distributions; 1.0% SD

exposed cases = 0.86; exposed non-cases = 0.95

unexposed cases = 0.96; unexposed non-cases = 0.99

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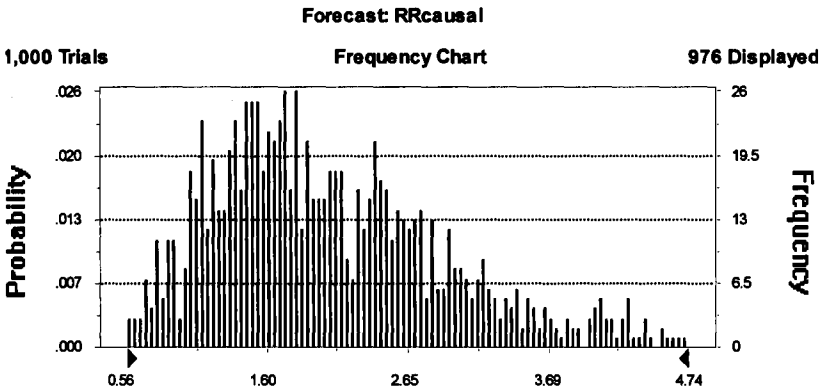
Missing Data: Triangular Distributions

cases: range = 0 – 7; likeliest value = 6

controls: range = 0 – 35; likeliest value = 21

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 2.2; Range = 0.6 – 6.8



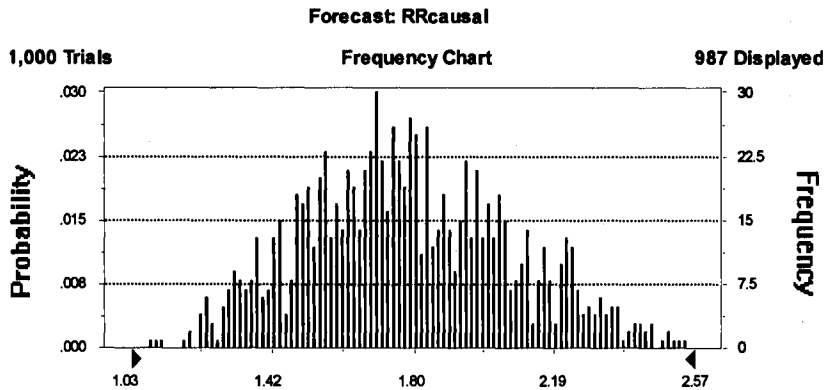
Triangular Distributions

cases: range = 0 – 7; likeliest value = 4

controls: range = 0 – 35; likeliest value = 17.5

Normal Distribution; Mean = 1.0; 1.0% SD

Mean = 1.8; Range = 1.0 – 3.0



F. Low. Vs. Medium/High Self-Regulation and Likelihood of Operating Tractors

Scenario 2 Priors:

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.92; exposed non-cases = 0.84;

unexposed cases = 0.84; unexposed non-cases = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

Scenario 3 Priors:

Uniform Distribution; Range = 0.99 – 1.01

Normal Distribution; 1.0% Standard Deviation (SD)

exposed cases = 0.92; exposed non-cases = 0.84;

unexposed cases = 0.84; unexposed non-cases = 0.90

Normal Distributions; 1.0% SD

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exposed cases = 0.76; exposed non-cases = 0.80

unexposed cases = 0.88; unexposed non-cases = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed non-cases = 0.95

unexposed cases = 0.96; unexposed non-cases = 0.99

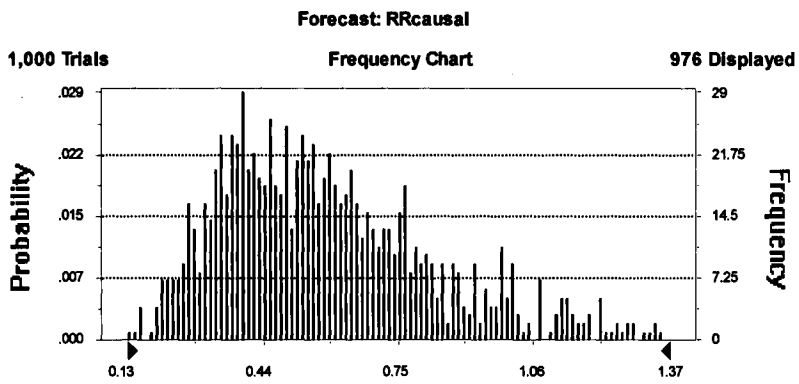
Missing Data: Triangular Distributions

cases: range = 0 – 7; likeliest value = 6

controls: range = 0 – 35; likeliest value = 21

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 0.6; Range = 0.1 – 2.0



exposed cases = 0.76; exposed non-cases = 0.80

unexposed cases = 0.88; unexposed non-cases = 0.92

Normal Distributions; 1.0% SD

exposed cases = 0.86; exposed non-cases = 0.95

unexposed cases = 0.96; unexposed non-cases = 0.99

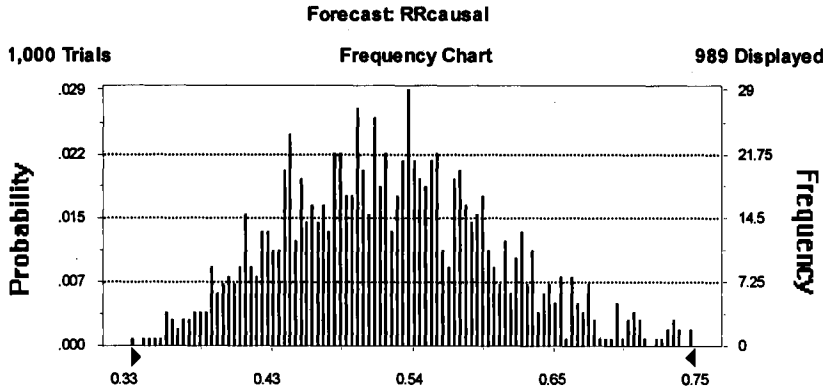
Triangular Distributions

cases: range = 0 – 7; likeliest value = 4

controls: range = 0 – 36; likeliest value = 17.5

Normal Distribution; Mean = 1.0; 1.0% SD

Mean = 0.5; Range = 0.3 – 0.9



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G. Fathers Previously Injured vs. Not and Children's Risk of Injury

Scenario 2 Priors:

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.90; exposed controls = 0.85;

unexposed cases = 0.95; unexposed controls = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

Missing Data: Triangular Distributions

cases: range = 0 – 14; likeliest value = 12

controls: range = 0 – 62; likeliest value = 50

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 2.6; Range = 0.5 – 12.8

Scenario 3 Priors:

Uniform Distribution; Range = 0.99 – 1.01

Normal Distribution; 1.0% Standard Deviation (SD)

exposed cases = 0.90; exposed controls = 0.85;

unexposed cases = 0.95; unexposed controls = 0.90

Normal Distributions; 1.0% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Normal Distributions; 1.0% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

Triangular Distributions

cases: range = 0 – 14; likeliest value = 8

controls: range = 0 – 62; likeliest value = 31

Normal Distribution; Mean = 1.0; 1.0% SD

Mean = 2.1; Range = 1.1 – 3.7

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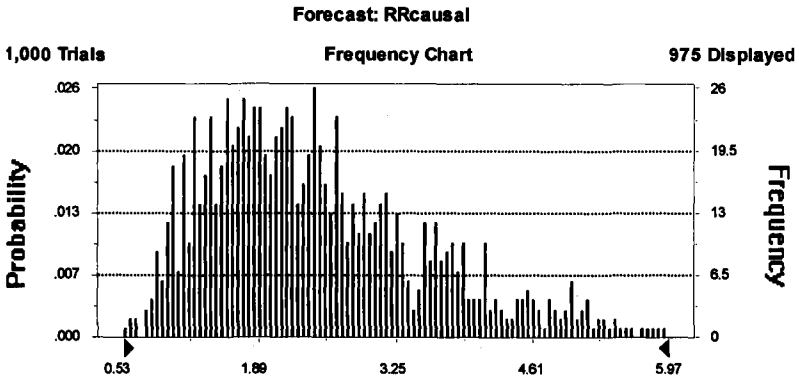

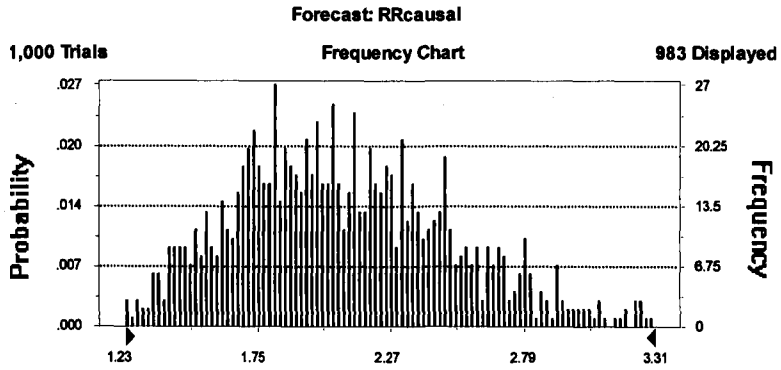

H. Mothers Previously Injured vs. Not and Children's Risk of Injury

Scenario 2 Priors:

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.90; exposed controls = 0.85;

unexposed cases = 0.95; unexposed controls = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

Scenario 3 Priors:

Uniform Distribution; Range = 0.99 – 1.01

Normal Distribution; 1.0% Standard Deviation (SD)

exposed cases = 0.90; exposed controls = 0.85;

unexposed cases = 0.95; unexposed controls = 0.90

Normal Distributions; 1.0% SD

exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Normal Distributions; 1.0% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

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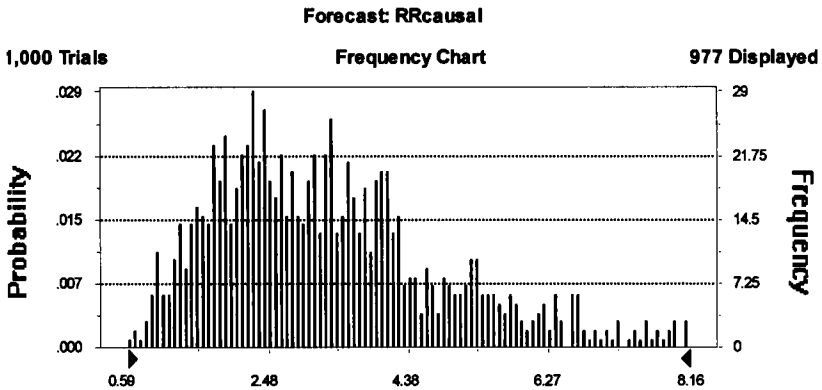
Missing Data: Triangular Distributions

cases: range = 0 – 15; likeliest value = 12

controls: range = 0 – 100; likeliest value = 80

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 3.5; Range = 0.6 – 13.5



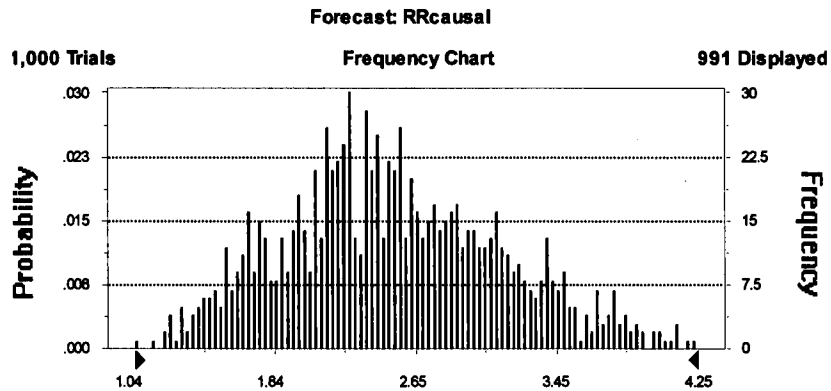
Triangular Distributions

cases: range = 0 – 15; likeliest value = 8

controls: range = 0 – 100; likeliest value = 50

Normal Distribution; Mean = 1.0; 1.0% SD

Mean = 2.5; Range = 1.0 – 5.0



I. Both Parents Previously Injured vs. Neither Ever Injured and Children's Risk of Injury

Scenario 2 Priors:

Confounding: Uniform Distribution; Range = 0.9 – 1.1

Measurement Error: Normal Distribution; 10% Standard Deviation (SD)

exposed cases = 0.90; exposed controls = 0.85;

unexposed cases = 0.95; unexposed controls = 0.90

Losses to Follow-Up: Normal Distributions; 10% SD

Scenario 3 Priors:

Uniform Distribution; Range = 0.99 – 1.01

Normal Distribution; 1.0% Standard Deviation (SD)

exposed cases = 0.90; exposed controls = 0.85;

unexposed cases = 0.95; unexposed controls = 0.90

Normal Distributions; 1.0% SD

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exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Non-Response: Normal Distributions; 10% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

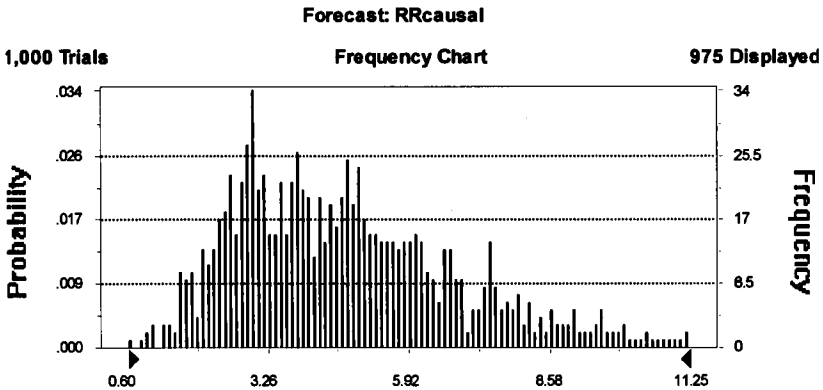
Missing Data: Triangular Distributions

cases: range = 0 – 15; likeliest value = 12

controls: range = 0 – 114; likeliest value = 90

Specification Error: Normal Distribution; Mean = 1.0; 10% SD

Distribution RR_{causal}: Mean = 4.9; Range = 0.6 – 18.9



exposed cases = 0.76; exposed controls = 0.80

unexposed cases = 0.88; unexposed controls = 0.92

Normal Distributions; 1.0% SD

exposed cases = 0.86; exposed controls = 0.95

unexposed cases = 0.96; unexposed controls = 0.99

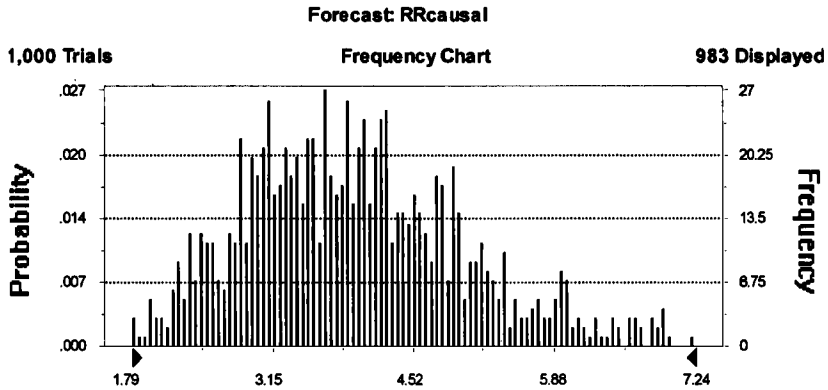
Triangular Distributions

cases: range = 0 – 15; likeliest value = 8

controls: range = 0 – 114; likeliest value = 57

Normal Distribution; Mean = 1.0; 1.0% SD

Mean = 4.0; Range = 1.6 – 8.9



APPENDICES

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APPENDIX A

INSTITUTIONAL REVIEW BOARD, HUMAN SUBJECTS APPROVAL

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irb@umn.edu, 02:59 PM 6/28/2005, Notification of IRB Exempt Study

X-From_: irb@umn.edu Tue Jun 28 14:59:45 2005
X-Umn-Remote-Mta: [N] mtaout-m.tc.umn.edu [160.94.23.21] #+LO+NM
X-Umn-Remote-Mta: [N] tamarack.oit.umn.edu [160.94.46.193] #+LO
Date: Tue, 28 Jun 2005 14:59:44 -0500 (CDT)
X-Authentication-Warning: tamarack.oit.umn.edu: nirvana set sender to irb@umn.edu using -f
From: irb@umn.edu
To: ferg0114@umn.edu
Subject: Notification of IRB Exempt Study
X-Status:
X-Keywords:

The IRB: Human Subjects Committee determined that the referenced study is exempt from review under federal guidelines 45 CFR Part 46.101(b) category #4 EXISTING DATA; RECORDS REVIEW; PATHOLOGICAL SPECIMENS.

Study Number: 0506E71006

Principal Investigator: Kathleen Ferguson

Title(s):
"Intra-Familial Risk OF Agriculture Injury: Associations Between Behavioral Traits And Environment Exposures." This Is A Secondary Analysis Of Data, With All Personal Indentifiers Removed, From "Etiology And Consequences Of Injuries Among Farm Children: A Regional Rural Injury Study (RRIS-II)" And "RRIS-II: Agricultural Injury Surveillance" (IRB Approval Numbers 9706S0138 And 9201S04814.)

The study number above is assigned to your research. That number and the title of your study must be used in all communication with the IRB office.

If you requested a waiver of HIPAA Authorization and received this e-mail, the waiver was granted. Please note that under a waiver of the HIPAA Authorization, the HIPAA regulation [164.528] states that the subject has the right to request and receive an accounting of Disclosures of PHI made by the covered entity in the six years prior to the date on which the accounting is requested.

If you are accessing a limited Data Set and received this email, receipt of the Data Use Agreement is acknowledged.

Upon receipt of this email, you may begin your research. If you have questions, please call the IRB office at (612) 626-5654.

You may go to the View Completed section of eResearch Central at http://eresearch.umn.edu/ to view further details on your study.

The IRB wishes you success with this research.

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Document Information

IACUC
Project Number: 0506E71006
PI: Ferguson, Kathleen R
Title: 'Intra-Familial Risk of Agriculture Injury: Associations between Behavioral Traits and Environment Exposures.' This is a Secondary Analysis of Data, with All Personal Indentifiers Removed, from 'Etiology and Consequences of Injuries among Farm Children: A Regional Rural Injury Study (RRIS-II)' and 'RRIS-II: Agricultural Injury Surveillance' (IRB Approval Numbers 9706S0138 and 9201S04814)

Protocol Type: (E) Exempt
Sub Type: General

Last Approval Date: 06/28/2005
Expiration Date:
Number of Subjects Approved: 32602

Personnel:
Ferguson, Kathleen R (ferg0114) Student PI
Alexander, Bruce H (balex) Co-Investigator
Gerberich, Susan G (gerbe001) Advisor
Ryan, Andrew (ryanx029) Correspondent

Study Number: 0506E71006	**Study Subtype:** General
Study Title(s):	'Intra-Familial Risk of Agriculture Injury: Associations between Behavioral Traits and Environment Exposures.' This is a Secondary Analysis of Data, with All Personal Indentifiers Removed, from 'Etiology and Consequences of Injuries among Farm Children: A Regional Rural Injury Study (RRIS-II)' and 'RRIS-II: Agricultural Injury Surveillance' (IRB Approval Numbers 9706S0138 and 9201S04814)
Principal Investigator:	Ferguson, Kathleen R ferg0114@umn.edu
Expiration Date:	
Submission History:	**Approval Date:**
New Application	06/28/2005

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APPENDIX B

RRIS–II STUDY MATERIALS

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UNIVERSITY OF MINNESOTA

Twin Cities Campus

Environmental and Occupational Health
School of Public Health

Box 807 Mayo
420 Delaware Street S.E.
Minneapolis, MN 55455
612-626-0900
Fax: 612-626-0650

REGIONAL RURAL INJURY STUDY - II

MINNESOTA

- Susan G. Gerberich, Ph.D., Principal Investigator, Regional Injury Prevention Research Center, University of Minnesota
- Robert W. Gibson, Ph.D. Co-Principal Investigator, Regional Injury Prevention Research Center, University of Minnesota
- L. Ronald French, Ph.D. Co-Principal Investigator, Minnesota Department of Health
- John Shutske, Ph.D. Co-Investigator and Agricultural Engineer, Agricultural Extension Service, University of Minnesota
- Michael Hunst, State Statistician, USDA National Agricultural Statistics Service

NEBRASKA

- David Morgan, Agricultural Engineer, Biological Systems Engineering Department, University of Nebraska
- David G. Loos, State Statistician, USDA National Agricultural Statistics Service

NORTH DAKOTA

- George G. Maher, Agricultural Safety Specialist, Extension Service, North Dakota State University
- Larry W. Beard, State Statistician, USDA National Agricultural Statistics Service

SOUTH DAKOTA

- Larry Tidemann, Coordinator, Cooperative Extension Service, South Dakota State University
- William G. Hamlin, State Statistician, USDA National Agricultural Statistics Service

WISCONSIN

- Mark A. Purschwitz, Ph.D. Extension Agricultural Safety and Health Specialist, Cooperative Extension Service, University of Wisconsin
- Robert J. Battaglia, State Statistician, USDA National Agricultural Statistics Service

Within the next month, you will be receiving a call inviting you to participate in a project concerned with farming operation activities and injuries in farm household members. This project, the Regional Rural Injury Study - II, is being conducted by the University of Minnesota and the USDA Agricultural Statistics Services, in cooperation with other agencies in your state as part of a five-state effort involving Minnesota, Wisconsin, North Dakota, South Dakota, and Nebraska. Your farm was randomly selected from all of the farms in these states. It is hoped that the information we collect from this project will help both in understanding the nature of injuries experienced in the agricultural community and in developing injury prevention programs.

Participation in this project will involve answering questions in three telephone interviews about your household members, your farm operation and about farming and non-farming-related injuries that have occurred to members of the household. In some households, children who have been injured as well as a random sample of those who have not been injured, will be asked questions about their activities for a particular period of time. The first interview will take approximately five minutes to complete and will take place in January, 1999. The second and third interviews, which can take between 10 minutes and an hour to complete, will be conducted in July, 1999 and January, 2000.

All of the information collected for this project will remain completely confidential. No information on individuals or individual farms will ever be released. Participation in this project is voluntary. However, to ensure that the information we collect is most helpful, it is very important for all eligible farms to participate, whether or not any injuries have occurred. Your relations with any of the agencies or institutions associated with this project and/or those identified on the letterhead will not be affected if you decide not to participate.

Each farm selected for this study will also be invited to participate in a drawing for a $100 Treasury Bond. Your farm household will have approximately a 1 in 100 chance to receive a bond. Though we would greatly appreciate your help, you are not required to participate in the study to be included in the drawing.

If you have any questions about the project, please contact our Project Director, or me, at (612) 626-4801 or (800) 944-0430 (toll free). We hope you will consider participating in this important effort. We look forward to talking with you!

Sincerely,

Susan Goodwin Gerberich, Ph.D.
Professor and Director
Regional Injury Prevention Research Center

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MINNESOTA AGRICULTURAL STATISTICS SERVICE

U.S. Department of Agriculture in cooperation with the Minnesota Department of Agriculture

FIELD(FIRSTNAME) FIELD(LASTNAME)
FIELD(ADDRDELIVE)
FIELD(PLACENAME), FIELD(STATEALPHA) FIELD(ZIP5)-FIELD(ZIP4)

Dear FIELD(FIRSTNAME) FIELD(LASTNAME):

The [state] Agricultural Statistics Service is collaborating with the University of Minnesota on a project that will provide information for development of prevention efforts to reduce injuries among farm/ranch household members. Your farm/ranch operation has been chosen at random from all [state] farms and ranches to participate in this project.

Within the next several weeks, a representative of our agency will call to ask for cooperation in this endeavor. *This first telephone call will take approximately five minutes.* Eligible farm/ranch households that agree to participate in the project will then be contacted after the first of July, this year, and after the first of January, next year, to complete telephone interviews. These interviews will include questions about the farming/ranching operation, persons who live on the farm/ranch, and about injuries that have occurred during the previous six-month periods; both farming/ranching and non-farming/non-ranching-related injuries are included.

To ensure complete information, it is important for all selected farms/ranches to participate whether, or not, any injuries have occurred. The enclosed letter further explains the project.

Thank you, in advance, for your participation in this important project.

Sincerely,

Michael Hunst

Michael Hunst
State Agricultural Statistician

8 East 4th Street, Suite 500 • St. Paul, MN 55101 • Ph: (651) 296-2230 • Fax: (651) 296-3192
E-mail: nass-mn@nass.usda.gov • Homepage: http://www.nass.usda.gov/mn/

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North Dakota
Agricultural
Statistics Service

P.O. Box 3166, Fargo, ND 58108-3166
Telephone: 701-239-5306 FAX: 701-239-5613
E-mail: nass-nd@nass.usda.gov

U.S. Department of Agriculture - National Agricultural Statistics Service

P.O. Box 3166, Fargo, ND 58108-3166
Telephone: 701-239-5306 FAX: 701-239-5613
E-mail: nass-nd@nass.usda.gov

FIELD(FIRSTNAME) FIELD(LASTNAME)
FIELD(ADDRDELIVE)
FIELD(PLACENAME), FIELD(STATEALPHA) FIELD(ZIP5)-FIELD(ZIP4)

Dear FIELD(FIRSTNAME) FIELD(LASTNAME):

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Within the next several weeks, a representative of our agency will call to ask for cooperation in this endeavor. *This first telephone call will take approximately five minutes.* Eligible farm/ranch households that agree to participate in the project will then be contacted after the first of July, this year, and after the first of January, next year, to complete telephone interviews. These interviews will include questions about the farming/ranching operation, persons who live on the farm/ranch, and about injuries that have occurred during the previous six-month periods; both farming/ranching and non-farming/non-ranching-related injuries are included.

To ensure complete information, it is important for all selected farms/ranches to participate whether, or not, any injuries have occurred. The enclosed letter further explains the project.

Thank you, in advance, for your participation in this important project.

Sincerely,

Larry Beard

Larry Beard
State Agricultural Statistician

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NASS NEBRASKA
Agricultural Statistics Service
P.O. BOX 81069, 273 FEDERAL BUILDING
LINCOLN, NEBRASKA 68501
PHONE: (402) 437-5541

FIELD(FIRSTNAME) FIELD(LASTNAME)
FIELD(ADDRDELIVE)
FIELD(PLACENAME), FIELD(STATEALPHA) FIELD(ZIP5)-FIELD(ZIP4)

Dear FIELD(FIRSTNAME) FIELD(LASTNAME):

The [state] Agricultural Statistics Service is collaborating with the University of Minnesota on a project that will provide information for development of prevention efforts to reduce injuries among farm/ranch household members. Your farm/ranch operation has been chosen at random from all [state] farms and ranches to participate in this project.

Within the next several weeks, a representative of our agency will call to ask for cooperation in this endeavor. *This first telephone call will take approximately five minutes.* Eligible farm/ranch households that agree to participate in the project will then be contacted after the first of July, this year, and after the first of January, next year, to complete telephone interviews. These interviews will include questions about the farming/ranching operation, persons who live on the farm/ranch, and about injuries that have occurred during the previous six-month periods; both farming/ranching and non-farming/non-ranching-related injuries are included.

To ensure complete information, it is important for all selected farms/ranches to participate whether, or not, any injuries have occurred. The enclosed letter further explains the project.

Thank you, in advance, for your participation in this important project.

Sincerely,

David G. Loos

David G. Loos
State Agricultural Statistician

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South Dakota Agricultural Statistics Service
Fact Finding for Agriculture

3528 S Western Ave PO Box 5068
Sioux Falls South Dakota 57117-5068
(605) 330-4235 Fax: (605) 330-4379

FIELD(FIRSTNAME) FIELD(LASTNAME)
FIELD(ADDRDELIVE)
FIELD(PLACENAME) FIELD(STATEALPHA), FIELD(ZIP5)-FIELD(ZIP4)

Dear FIELD(FIRSTNAME) FIELD(LASTNAME):

The [state] Agricultural Statistics Service is collaborating with the University of Minnesota on a project that will provide information for development of prevention efforts to reduce injuries among farm/ranch household members. Your farm/ranch operation has been chosen at random from all [state] farms and ranches to participate in this project.

Within the next several weeks, a representative of our agency will call to ask for cooperation in this endeavor. *This first telephone call will take approximately five minutes.* Eligible farm/ranch households that agree to participate in the project will then be contacted after the first of July, this year, and after the first of January, next year, to complete telephone interviews. These interviews will include questions about the farming/ranching operation, persons who live on the farm/ranch, and about injuries that have occurred during the previous six-month periods; both farming/ranching and non-farming/non-ranching-related injuries are included.

To ensure complete information, it is important for all selected farms/ranches to participate whether, or not, any injuries have occurred. The enclosed letter further explains the project.

Thank you, in advance, for your participation in this important project.

Sincerely,

Bill Hamlin

Bill Hamlin
State Agricultural Statistician

❖ United States Department of Agriculture – National Agricultural Statistics Service ❖

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Wisconsin Agricultural Statistics Service
P.O. Box 8934
Madison, WI 53708-8934
(608) 224-4848
National Agricultural Statistics Service, USDA
WI Department of Agriculture, Trade & Consumer Protection

FIELD(FIRSTNAME) FIELD(LASTNAME)
FIELD(ADDRDELIVE)
FIELD(PLACENAME), FIELD(STATEALPHA) FIELD(ZIP5)-FIELD(ZIP4)

Dear FIELD(FIRSTNAME) FIELD(LASTNAME):

The [state] Agricultural Statistics Service is collaborating with the University of Minnesota on a project that will provide information for development of prevention efforts to reduce injuries among farm/ranch household members. Your farm/ranch operation has been chosen at random from all [state] farms and ranches to participate in this project.

Within the next several weeks, a representative of our agency will call to ask for cooperation in this endeavor. *This first telephone call will take approximately five minutes.* Eligible farm/ranch households that agree to participate in the project will then be contacted after the first of July, this year, and after the first of January, next year, to complete telephone interviews. These interviews will include questions about the farming/ranching operation, persons who live on the farm/ranch, and about injuries that have occurred during the previous six-month periods; both farming/ranching and non-farming/non-ranching-related injuries are included.

To ensure complete information, it is important for all selected farms/ranches to participate whether, or not, any injuries have occurred. The enclosed letter further explains the project.

Thank you, in advance, for your participation in this important project.

Sincerely,

Robert J. Battaglia

Robert J. Battaglia
State Statistician

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UNIVERSITY OF MINNESOTA

Twin Cities Campus

Environmental and Occupational Health
School of Public Health

Box 807 Mayo
420 Delaware Street S.E.
Minneapolis, MN 55455
612-626-0900
Fax: 612-626-0650

REGIONAL RURAL INJURY STUDY - II COLLABORATORS

MINNESOTA

- Susan G. Gerberich, Ph.D., Principal Investigator, Regional Injury Prevention Research Center, University of Minnesota
- Robert W. Gibson, Ph.D. Co-Principal Investigator, Regional Injury Prevention Research Center, University of Minnesota
- L. Ronald French, Ph.D. Co-Principal Investigator, Minnesota Department of Health
- John Shutske, Ph.D. Co-Investigator and Agricultural Engineer, Agricultural Extension Service, University of Minnesota
- Michael Hunst, State Statistician, USDA National Agricultural Statistics Service

NEBRASKA

- David Morgan, Agricultural Engineer, Biological Systems Engineering Department, University of Nebraska
- David G. Loos, State Statistician, USDA National Agricultural Statistics Service

NORTH DAKOTA

- George G. Maher, Agricultural Safety Specialist, Extension Service, North Dakota State University
- Larry W. Beard, State Statistician, USDA National Agricultural Statistics Service

SOUTH DAKOTA

- Larry Tidemann, Coordinator, Cooperative Extension Service, South Dakota State University
- William G. Hamlin, State Statistician, USDA National Agricultural Statistics Service

WISCONSIN

- Mark A. Purschwitz, Ph.D. Extension Agricultural Safety and Health Specialist, Cooperative Extension Service, University of Wisconsin
- Robert J. Battaglia, State Statistician, USDA National Agricultural Statistics Service

[DATE]

[NAME/ADDRESS]

Dear [NAME]:

Thank you for your willingness to participate in the project, the Regional Rural Injury Study II, that is being conducted by the University of Minnesota and the USDA National Agricultural Statistics Services, in cooperation with other agencies in your state. The information that you can provide will help in better understanding the range of farming/ranching activities and the nature of injuries experienced in the agricultural community. This project, which will be used to develop injury prevention programs, is being conducted in the five states of Minnesota, Wisconsin, North Dakota, South Dakota, and Nebraska; your farm or ranch was randomly selected from all the farms and ranches in these states.

As you know, you will be contacted for telephone interviews sometime after July 1st of this year to provide information on the first six months of 1999 and, again, after January 1st, next year, to provide information on the second six months of 1999. The interviews will include questions about your household members, your farm operation, and about *both farming and non-farming-related injuries* that have occurred to members of your household during those periods of time. In some households, children who have been injured, as well as a random sample of those who have not been injured, will be asked questions about their farming/ranching activities and other activities for a particular period of time. The interviews are estimated to take between 30 and 45 minutes to complete.

For the first interview, to be conducted after July 1st, a packet of cards is enclosed to help the interview proceed more quickly and efficiently. Please fill out the information, as appropriate, and keep the cards near your telephone.

All the information collected for this project will remain completely confidential. No information on individuals or farms/ranches will ever be released.

As you know, every farm selected for this project is eligible to participate in a drawing for a $100 Treasury Bond. Your household will have at least a 1 in 32 chance to receive a bond.

To ensure that complete information is obtained, it is very important for all farms to participate whether, <u>or not</u>, any injuries occur during 1999. If you have any questions about the project, please contact our Project Director, or me, at 612-624-4801 or 1-888-260-8636 (toll-free).

Sincerely,

Susan Goodwin Gerberich, Ph.D.
Professor and Director
Regional Injury Prevention Research Center

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MINNESOTA AGRICULTURAL STATISTICS SERVICE

U.S. Department of Agriculture in cooperation with the Minnesota Department of Agriculture

FIELD(FIRSTNAME) FIELD(LASTNAME)
FIELD(ADDRDELIVE)
FIELD(PLACENAME), FIELD(STATEALPHA) FIELD(ZIP5)-FIELD(ZIP4)

Dear FIELD(FIRSTNAME) FIELD(LASTNAME):

As you know the Minnesota Agricultural Statistics Service is collaborating with the University of Minnesota on a five state regional project that will provide information for development of prevention efforts to reduce injuries among farm household members. We greatly appreciate your willingness to participate in this project.

Sometime after July 1st, of this year, a representative of our agency will call to conduct an interview that will include questions about farming activities, persons who live in your farm household, and about injuries that have occurred to *any* household members between January 1st and June 30th, 1999; *both farming and non-farming-related injuries are included.*

To ensure complete information, it is important for all selected farms to participate in this interview whether, or not, any injuries have occurred. The enclosed letter further explains the project which will also include a second interview after January 1st of next year.

Thank you for your participation in this important project!

Sincerely,

Michael Hunst

Michael Hunst
State Agricultural Statistician

8 East 4th Street, Suite 500 • St. Paul, MN 55101 • Ph: (651) 296-2230 • Fax: (651) 296-3192
E-mail: nass-mn@nass.usda.gov • Homepage: http://www.nass.usda.gov/mn/

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North Dakota
Agricultural
Statistics Service

U.S. Department of Agriculture - National Agricultural Statistics Service

P.O. Box 3166, Fargo, ND 58108-3166
Telephone: 701-239-5306 FAX: 701-239-5613
E-mail: nass-nd@nass.usda.gov

FIELD(FIRSTNAME) FIELD(LASTNAME)
FIELD(ADDRDELIVE)
FIELD(PLACENAME), FIELD(STATEALPHA) FIELD(ZIP5)-FIELD(ZIP4)

Dear FIELD(FIRSTNAME) FIELD(LASTNAME):

As you know the North Dakota Agricultural Statistics Service is collaborating with the University of Minnesota on a five state regional project that will provide information for development of prevention efforts to reduce injuries among farm household members. We greatly appreciate your willingness to participate in this project.

Sometime after July 1st, of this year, a representative of our agency will call to conduct an interview that will include questions about farming activities, persons who live in your farm household, and about injuries that have occurred to *any* household members between January 1st and June 30th, 1999; *both farming and non-farming-related injuries are included.*

To ensure complete information, it is important for all selected farms to participate in this interview whether, or not, any injuries have occurred. The enclosed letter further explains the project which will also include a second interview after January 1st of next year.

Thank you for your participation in this important project!

Sincerely,

Larry Beard

Larry Beard
State Agricultural Statistician

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NASS *NEBRASKA*
Agricultural Statistics Service
P.O. BOX 81069, 273 FEDERAL BUILDING
LINCOLN, NEBRASKA 68501
PHONE: (402) 437-5541

FIELD(FIRSTNAME) FIELD(LASTNAME)
FIELD(ADDRDELIVE)
FIELD(PLACENAME), FIELD(STATEALPHA) FIELD(ZIP5)-FIELD(ZIP4)

Dear FIELD(FIRSTNAME) FIELD(LASTNAME):

As you know the Nebraska Agricultural Statistics Service is collaborating with the University of Minnesota on a five state regional project that will provide information for development of prevention efforts to reduce injuries among farm household members. We greatly appreciate your willingness to participate in this project.

Sometime after July 1st, of this year, a representative of our agency will call to conduct an interview that will include questions about farming activities, persons who live in your farm household, and about injuries that have occurred to *any* household members between January 1st and June 30th, 1999; *both farming and non-farming-related injuries are included.*

To ensure complete information, it is important for all selected farms to participate in this interview whether, or not, any injuries have occurred. The enclosed letter further explains the project which will also include a second interview after January 1st of next year.

Thank you for your participation in this important project!

Sincerely,

David G. Loos

David G. Loos
State Agricultural Statistician

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South Dakota Agricultural Statistics Service
Fact Finding for Agriculture

3528 S Western Ave PO Box 5068
Sioux Falls South Dakota 57117-5068
(605) 330-4235 Fax (605) 330-4379

FIELD(FIRSTNAME) FIELD(LASTNAME)
FIELD(ADDRDELIVE)
FIELD(PLACENAME) FIELD(STATEALPHA), FIELD(ZIP5)-FIELD(ZIP4)

Dear FIELD(FIRSTNAME) FIELD(LASTNAME):

As you know the South Dakota Agricultural Statistics Service is collaborating with the University of Minnesota on a five state regional project that will provide information for development of prevention efforts to reduce injuries among farm household members. We greatly appreciate your willingness to participate in this project.

Sometime after July 1st, of this year, a representative of our agency will call to conduct an interview that will include questions about farming activities, persons who live in your farm household, and about injuries that have occurred to *any* household members between January 1st and June 30th, 1999; *both farming and non-farming-related injuries are included.*

To ensure complete information, it is important for all selected farms to participate in this interview whether, or not, any injuries have occurred. The enclosed letter further explains the project which will also include a second interview after January 1st of next year.

Thank you for your participation in this important project!

Sincerely,

Bill Hamlin

Bill Hamlin
State Agricultural Statistician

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Wisconsin Agricultural Statistics Service
P.O. Box 8934
Madison, WI 53708-8934
(608) 224-4848
National Agricultural Statistics Service, USDA
WI Department of Agriculture, Trade & Consumer Protection

FIELD(FIRSTNAME) FIELD(LASTNAME)
FIELD(ADDRDELIVE)
FIELD(PLACENAME), FIELD(STATEALPHA) FIELD(ZIP5)-FIELD(ZIP4)

Dear FIELD(FIRSTNAME) FIELD(LASTNAME):

As you know the Wisconsin Agricultural Statistics Service is collaborating with the University of Minnesota on a five state regional project that will provide information for development of prevention efforts to reduce injuries among farm household members. We greatly appreciate your willingness to participate in this project.

Sometime after July 1st, of this year, a representative of our agency will call to conduct an interview that will include questions about farming activities, persons who live in your farm household, and about injuries that have occurred to *any* household members between January 1st and June 30th, 1999; *both farming and non-farming-related injuries are included.*

To ensure complete information, it is important for all selected farms to participate in this interview whether, or not, any injuries have occurred. The enclosed letter further explains the project which will also include a second interview after January 1st of next year.

Thank you for your participation in this important project!

Sincerely,

Robert J. Battaglia

Robert J. Battaglia
State Statistician

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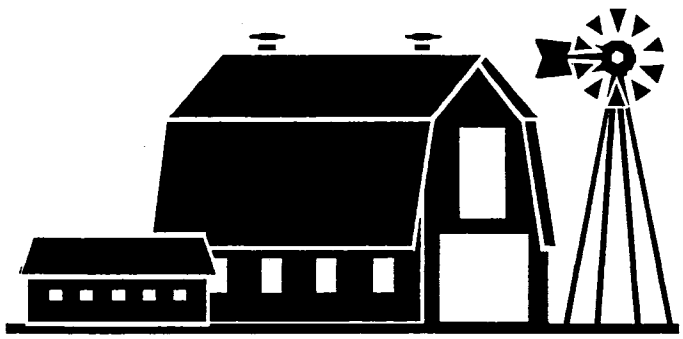
Regional Rural Injury Study II

A PROJECT TO REDUCE INJURIES AMONG FARM AND RANCH HOUSEHOLD MEMBERS



Collaboration between the University of Minnesota and the USDA National Agricultural Statistics Service

CONTACT INFORMATION:

Susan Gerberich, PhD
Professor and Director
Regional Injury Prevention Research Center
Division of Environmental and Occupational Health
School of Public Health
University of Minnesota
Box 807 Mayo
420 Delaware Street SE
Minneapolis, MN 55455
612-626-4801
1-888-260-8636 (toll-free)

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REGIONAL RURAL INJURY STUDY-II

INTERVIEW INFORMATION CARDS

The following color-coded cards are designed to make the telephone interview, that will be conducted sometime after July 1st, 1999, go as quickly and smoothly as possible. Please take some time to go through these cards with the members of your household before the interview. Where possible, fill in any information that is noted on the colored cards, and update it as necessary.

The sequence and type of information that will be requested includes:

1. Household Members

You will be asked general questions about the people living in your household. For this portion of the interview you will be asked to refer to the **gold card** in your packet to assist in answering these questions.—*It would be helpful to fill this one out ahead of time.*

2. Accidents/Injuries

You will be asked about any accidents/injuries that occurred to *any members* of your household between January 1, 1999 and June 30, 1999. (A calendar is provided at the back of this packet for your reference.) *These accidents/injuries may have resulted from either farming/ranching-related or nonfarming/non-ranching-related activities.* The following cards from your packet will assist you in answering these questions:

- **Light blue card**: Injury Definition
- **Dark blue card**: Location of Injury/Body Parts Affected (refer to figure)
- **Beige cards**: Types of Injuries/Persistent Problems
- **Rose cards**: List of Persons Injured/Details About Injury Event(s)—*It would be helpful to fill this one out ahead of time.*

3. Activities

In some households, questions will also be asked about activities and experiences of selected children; these experiences include the following:

- farming/ranching activities, including work or activities with animals, tractors and other large farm/ranch equipment
- school and other non-farm/non-ranch activities
- general health information
- farm/ranch safety training

Both parents and selected children, 12 years of age and older, may be asked questions during this portion of the interview; parents will be asked to respond for children less than 12 years of age.

4. General Farm Operation -

We will ask a few general questions about your farming/rranching operation.

PLEASE KEEP THESE CARDS NEXT TO YOUR TELEPHONE SO THAT YOU CAN USE THEM WHEN THE INTERVIEWER CALLS.

Thank you!

- LIGHT GREEN -

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HOUSEHOLD MEMBERS

In part of the interview, we will ask some general questions about each person who was a **member of your household as of January 1st, 1999.** [This includes persons who **moved or died after January 1st, 1999**; it includes students away at college or children who reside in multiple households, including yours, etc.] Please provide the following information on these household members:

All household members as of January 1st, 1999: Full Name	Date of Birth	Number of months worked or did chores on your farming/ranching operation between January 1st and June 30th, 1999	Number of weeks per month worked or did chores on your farming/ranching operation between January 1st and June 30th, 1999	Hours per week on average worked or did chores on your farming/ranching operation between January 1st and June 30th, 1999	Covered by medical/health care insurance (Yes/No) between January 1st and June 30th, 1999

INJURY DEFINITION

In this project, **any of the following** that occurred between **January 1, 1999 and June 30, 1999** will be included as an accident/injury:

- **Any accident/injury restricting normal activities for at least four hours; and/or**
- **Loss of consciousness, loss of awareness, or amnesia for any length of time (for example, due to a blow to the head or being overcome by fumes); and/or**
- **Any accident/injury for which professional care was sought (for example, seeing a doctor, nurse, dentist, chiropractor or other healthcare professional).**

All accidents/injuries that fit any part of the injury definition above are to be included.

This includes both farming/ranching and non-farming/non-ranching activity-related accidents/injuries that were minor, serious or fatal.

Some examples of injuries and sources of the injuries:

- A brain injury resulting from a fall
- A broken arm from working with machinery
- An animal bite or kick
- A brief loss of consciousness after breathing a toxic gas such as silo gas or manure pit gas
- A burn or blister due to heat or chemical contact
- Abdominal injuries resulting from a motor vehicle crash
- A leg fracture from a sports or recreational activity
- Strained/pulled back from lifting, twisting, etc.
- Cut/laceration from working with a tool
- Bruise/contusion from falling item or being struck by/against equipment or an animal

— LIGHT BLUE —

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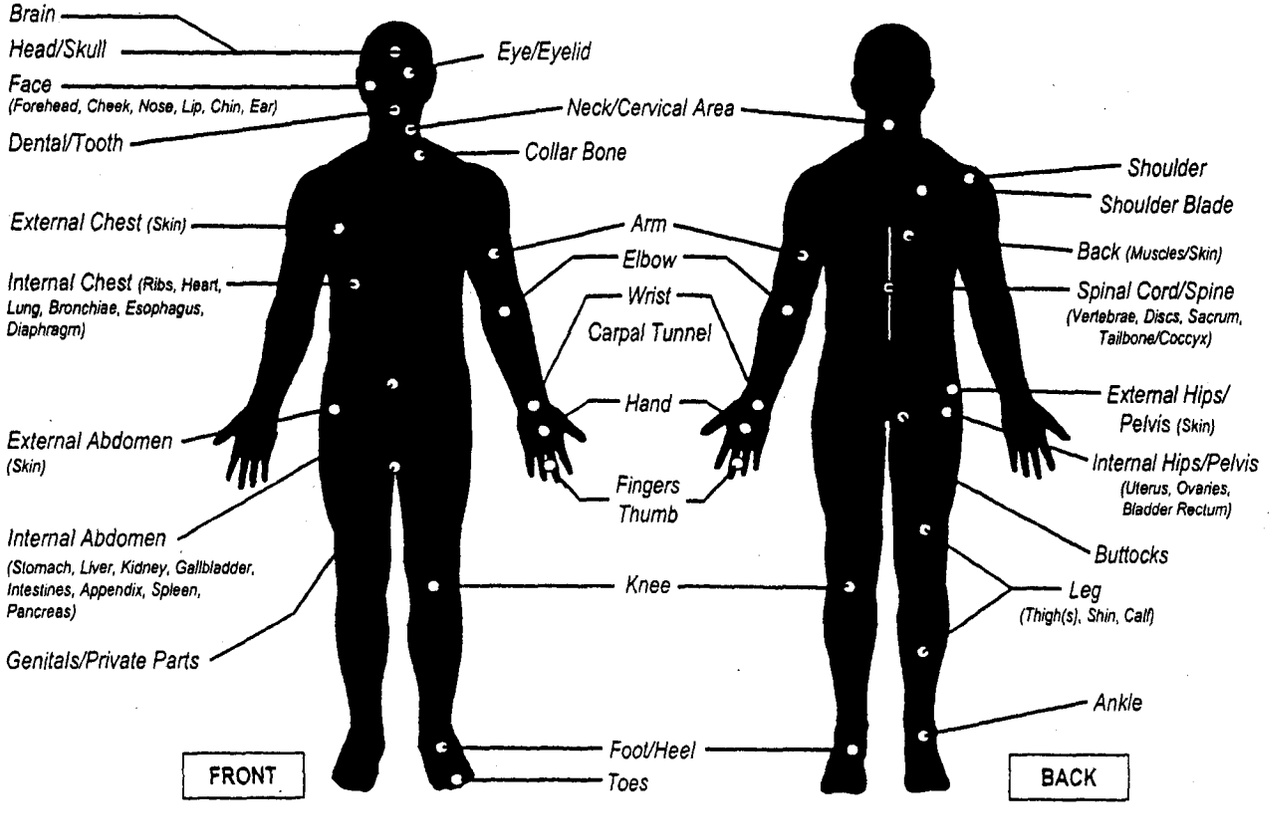
The following diagrams may be of assistance in describing the exact location(s) of each injury that we discuss during the interview.



Includes internal and external injuries

TYPES OF INJURIES/PERSISTENT PROBLEMS

During the telephone interview, you will be asked about the *type of injury* for each part of the body that was injured, according to the injury definition. You will also be asked about *persistent problems* or *symptoms* resulting from the injuries. The following list may help in describing these injuries.

Using the information below, please record the type of injury for household members injured either on or off the farm/ranch in a farming/ranching or non-farming/non-ranching-related accident/injury between January 1, 1999 and June 30, 1999. Also, identify any persistent problems or symptoms. Please use the **rose cards** for this purpose and have them on hand for the interview.

TERM	DESCRIPTION
Scrape/Abrasion	Removal of skin, or portion of skin
Bruise/Contusion	Discoloration of the skin or other soft tissue due to blood clotting within the soft tissue
Burn/Blister/Scald	Lesion/wound of the skin due to heat or chemical exposure
Sprain/Strain/ Torn Ligament	Injury to the soft tissue of a joint/muscle or tissue connecting cartilage or organs
Cut/Laceration	Tearing of soft tissue/skin
Puncture/Stab/Jab	Wound made by a piercing instrument
Broken Bone/Fracture	Break of bone or cartilage
Dislocation	Disturbance of the normal relation of a bone and joint
Traumatic Rupture	Tearing or bursting of internal organ tissue due to physical force
Crushed/Mangled	Severe and multiple injuries due to being caught in, under, or between objects
Loss of Body Part	Loss of a limb or other body part
Nerve Injury	Injury to a nerve, which may result in numbness, tingling, or weakness of a portion of the body

➡ CONTINUED ON NEXT PAGE ➡

— BEIGE —

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— TYPES OF INJURIES/PERSISTENT PROBLEMS – Continued

TERM	DESCRIPTION
Poisoning	Swallowing a poisonous or toxic substance or skin/eye contact with substance
Concussion/Loss of Consciousness/ Loss of Awareness	Injury involving loss of consciousness for any length of time due to a blow to the head or neck or from inhalation of toxic fumes
Suffocation/Choking	Suffocation or choking as a result of something caught in the throat or as a result of a blow to the throat or strangulation
Drowning or Near Drowning	Fatal or non-fatal injury resulting from immersion in liquid or solid, granular substances
Paralysis	Any type of paralysis (temporary or permanent) or inability to move part or parts of the body
Pain	Discomfort or pain at any site in the body as a result of an injury event

PERSISTENT PROBLEMS OR SYMPTOMS RESULTING FROM INJURIES

Continued problems or symptoms following the injury event may include the following:

- Pain
- Numbness or tingling
- Persistent or recurrent headache
- Paralysis
- Loss of body part
- Weakness/fatigue
- Decreased range of motion
- Impaired vision, speech, or hearing
- Dizziness
- Reduced ability to concentrate or do physical work
- Epilepsy
- Convulsions/seizures.

— BEIGE —

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PERSONS INJURED

At the time of the telephone interview, it will be helpful if the information below is available for **all members of your household** who were injured **between January 1st and June 30th, 1999. Please include both farming/ranching and non-farming/non-ranching-related injuries.**

Name	Date of Injury	Where Injury Happened	How Injury Happened	Source of Injury (e.g., Animals, Tractors, Large Machinery, Small Power/Hand Tools, Chemicals, Sports, Housework, Fall)	Body Part Injured (See Figure)	Type of Injury (See Beige Card)	Current Persistent Problems/ Symptoms (See Beige Card)	Length of Restriction of Normal Activity (Hours, Days, Months)

➡ Continue to next page, as necessary ➡

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PERSONS INJURED--Continued

Name	Date of Injury	Where Injury Happened	How Injury Happened	Source of Injury (e.g., Animals, Tractors, Large Machinery, Small Power/Hand Tools, Chemicals, Sports, Housework, Fall)	Body Part Injured (See Figure)	Type of Injury (See Beige Card)	Current Persistent Problems/ Symptoms (See Beige Card)	Length of Restriction of Normal Activity (Hours, Days, Months)

January 1999						
Sun	Mon	Tues	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February 1999						
Sun	Mon	Tues	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

March 1999						
Sun	Mon	Tues	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

April 1999						
Sun	Mon	Tues	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

May 1999						
Sun	Mon	Tues	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June 1999						
Sun	Mon	Tues	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

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APPENDIX C

COMPUTER-ASSISTED TELEPHONE INTERVIEW (CATI) INSTRUMENTS

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RRIS II: Agricultural Injury Surveillance

1 RO1 OH04270

Participation Interview
2001

Administered by specially trained interviewers, using a Computer-Assisted Telephone Interview (CATI) Instrument

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-- Script Before Entering CATI Program –

Dial number from call sheet prepared by the USDA National Agricultural Statistics Service (NASS).

When someone answers the phone –

Ask:

"Hello, is this the >Operator__Last_Name< residence?"

If it is not the residence you are calling, follow standard NASS procedures verifying number, etc

If it's the correct household:

Ask: ***"May I please speak with the female head of household?"***

Female head of household comes to the phone (*continue interview*)

Female head of household is unavailable (*go to >callback<*)

There is no female head of household -

Ask: ***"Then, may I please speak to the male head of household?"***

Male head of household comes to the phone (*continue interview*)

Male head of household is unavailable (*go to >callback<*)

<u>Please</u> enter a comment that there is no female head of household, so the enumerator who places the next call will know to ask for the male head of household.

-- When an appropriate respondent (female or male head of household) has come to the phone begin the CATI interview --

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>intro< "Hello, this is >EnumName< calling for the >StateName< agricultural statistics service. I am calling to follow-up on the letters sent to you by the USDA (StateName) Agricultural Statistics Service regarding a project on farm and ranch households we are conducting with the University of Minnesota. Did you receive the letters?"

1 Yes *(go to **>few_questions<**)*
3 No
9 Refusal *(go to **>reconsider6<**)*

>newletter< "Since you did not receive the letters, would you like us to send you new copies?"

1 Yes
3 No
9 Refusal *(go to **>reconsider6<**)*

>few_questions< "We'd like to ask you a few questions to see if you qualify for the project? This should only take 5 minutes. May we continue?"

1 Yes
3 No *(go to **>reconsider6<**)*

>Monitoring< "For quality control purposes, my supervisor may monitor this call."

1 *Continue*

>Obtain_Name< "With whom am I Speaking?" *[Enumerator: Who is the current respondent? Enter name.]*

_____

>Who_Resp< *[Enumerator: Who is the respondent? ... Enter code.]*

1 Female head of household
3 Male head of household

>farm_qualify1< "Is this >Operator_Name<'s household? (Residence including farm families or people who live in the household.)"

1 Yes *(go to **>verify_address<**)*
3 No

>screen_4< "Does >Operator_Name< have a household associated with this operation? (Residence including farm families or people who live in the household.)"

1 Yes
3 No *(go to **>not_qual<**)*

>verify_address< "Let me verify the name and address that I have for your household.

•YID/KeyID

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•Operation

•Address

•Phone

Is this information correct?"

1 Yes *(go to* ***>speak2<****)*
3 No

>EnumInst< *[Enumerator: If Operator_name is correct, correct household address, then return through >verify_address< to >speak2<. If Operator_name is incorrect (not current), exit and return callsheet to supervisor.]*

>speak2< "Your farm or ranch was randomly selected as a potential participant in a project about farming and ranching activities and injuries that MAY occur during 2001. The results from the project will be used to develop injury prevention programs that will benefit all agricultural households. You are also eligible for a drawing for a $100 treasury bond. You are not required to participate in the project to be included in the drawing."

1 *Continue*

>speak2b< "In this short interview, we only want to ask a few questions about your operation and the ages of the people in your household, so that we can tell if you are eligible to be in the project. May we continue?"

1 Yes
3 No *(go to* ***>responses1<****)*

>farm_qualify2< "As of January 1st, 2001, were you actively farming or ranching or did you have land in a Conservation Reserve Program (CRP)?"

1 Yes
3 No *(go to* ***>not_qual<****)*

>active_farm1< "During the past year, did you produce or have annual sales of agricultural goods of $1,000 or more or were you involved in a Conservation Reserve Program (CRP)?"

1 Yes
3 No *(go to* ***>not_qual<****)*

>farm_qualify3< "We need to obtain brief information on the members of your household as of JANUARY 1st, 2001. How many household members were there, including those who moved or passed away after January 1, 2001? This includes students away at college or children who reside in multiple households, including yours, etc." *[Enumerator: If respondent is uncertain, prompt them for their best estimate.]*

__ 1 – 20
98 Uknown *(go to* ***>callback<****)*
99 Refusal *(go to* ***>reconsider5<****)*

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>persons20< "How many persons in your household were 20 years of age or OLDER as of January 1, 2001? Remember, if someone is 20 today but their birthday was between January 1st and today, they were 19 on January 1st." *[Enumerator: If the respondent is uncertain, prompt them for their best estimate.]*

0 None
__ 1 - 12
98 Uknown *(go to* ***>callback<****)*
99 Refusal

>persons19< "How many persons in your household were 19 years of age or YOUNGER?"

[If respondent is uncertain, prompt them for their best estimate.]
0 None
__ 1 - 12
98 Uknown *(go to* ***>callback<****)*
99 Refusal

>HH_total< "Let me verify the number of household members. I have recorded a total number of >persons20< persons 20 years of age and over, and >persons19< persons 19 and under living in this household as of January 1, 2001. Is this correct?"

1 Yes
3 No *(go to* ***>persons20<****)*

>AnyKids< *[Programming Note: If (>persons19< = 0) go to >not_qual2<]*

>inf_consent1< "Your farm or ranch household is eligible for our project. We would appreciate your help with this project. Participation in the project WILL involve answering questions about your farm or ranch operation and about any accidents or injuries that may occur either on or off the operation through the end of December 2001."

"If you agree to take part in the project, we will be calling you back sometime after July 1st, this year, and after January 1st, of next year, to get information about your farming or ranching activities and any injuries that may have occurred during EACH six month period of 2001. Only group information, not individual information, will ever be used in any report on this project. Participation is voluntary but your cooperation would be very helpful. Whether or not you choose to participate in the project, you may enroll in the random drawing, with at least a 1 in 32 chance of receiving a $100 treasury bond. Would you be willing to help us?"

1 Yes
3 No *(go to* ***>reconsider2<****)*

>drawing1< "You are eligible for the drawing for a $100 treasury bond. We will notify the households that are awarded the bonds at the completion of the

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project. [*Sometime in 2002.*] Would you like to be included in the drawing?"

1 Yes
3 No

>final_sign_off < "Those are all the questions I have for you today. Thank you very much for agreeing to participate in this important project. In a few weeks you will receive a packet of information about the project in the mail. This will include a form on which to record any injuries that may occur during the few months before we call you again."

"On behalf of all those involved in this project, I thank you for your time and participation. We look forward to talking with you sometime after July 1st."

[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (1) COMPLETED INTERVIEW.*]*

>reconsider2< "Your participation will be very important in efforts to reduce farm and ranch accidents and injuries for ALL agricultural families. It is important to include ALL types of agricultural operations, whether or not there were accidents or injuries. This will help in better understanding both farming or ranching activities and injuries in your region. Would you reconsider participating?"

1 Yes *(go to* ***>drawing1<****)*
3 No *(go to* ***>drawing2<****)*

>reconsider4< "Your farm or ranch may qualify for the project. May we ask a few more questions?"

1 Yes *(go to* ***>active_farm1<****)*
3 No *(go to* ***>drawing3<****)*

>reconsider5< "This information is important to determine whether your household qualifies for the project. There are only a few more questions. May we continue?"

1 Yes *(go to* ***>farm_qualify3<****)*
3 No *(go to* ***>drawing2<****)*

>reconsider6< "Your participation in this project would make a valuable contribution. Every household we call is eligible to be included in a drawing for a $100 treasury bond. We would appreciate your help. It will only take 5 minutes. May we continue?"

1 Yes *(go to* ***>monitoring<****)*
3 No *(go to* ***>sign_off3<****)*

>responses1< *[Enumerator: If respondent doesn't volunteer a reason for their refusal, ask:* "Could you tell me the reason that you prefer not to participate in this interview?", *then enter the appropriate response.]*

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1 We didn't (don't have) any injuries *(go to* ***>resp11<****)*
2 Operation too small *(go to* ***>resp12<****)*
3 Haven't been farming long enough *(go to* ***>resp13<****)*
4 Don't like surveys or Just don't want to do it *(go to* ***>resp14<****)*
5 I'm (we're) too busy or Don't have time *(go to* ***>resp15<****)*
6 (Personal Crisis) *(go to* ***>resp16<****)*

>resp11< "We're including ALL types of farming and ranching operations, whether or not there were accidents or injuries. May we continue?"

1 Yes *(go to* ***>farm_qualify2<****)*
3 No *(go to* ***>drawing3<****)*

>resp12< "We're including all sizes of farms and ranches. May we continue?"

1 Yes *(go to* ***>farm_qualify2<****)*
3 No *(go to* ***>drawing3<****)*

>resp13< "We're including all operations that were actively farming or ranching as of January 1st, 2001, or had land in a Conservation Reserve Program (CRP). Is this true for your operation?"

1 Yes *(go to* ***>reconsider4<****)*
3 No *(go to* ***>not_qual<****)*

>resp14< "This project is very important for the entire agricultural community. Your participation could really make a difference. There are only a few more questions. May we continue?"

1 Yes *(go to* ***>farm_qualify2<****)*
3 No *(go to* ***>drawing3<****)*

>resp15< "We understand that you are very busy. However, these questions will only take 5 minutes and your input would make a valuable contribution. May we continue?"

1 Yes *(go to* ***>farm_qualify2<****)*
3 No *(go to* ***>call_you<****)*

>call_you< "May we call you back at another time that is more convenient for you."

1 Yes *(go to* ***>callback<****)*
3 No *(go to* ***>drawing3<****)*

>resp16< "May we call you back at another time that is more convenient for you."

1 Yes *(go to* ***>callback<****)*
3 No *(go to* ***>drawing3<****)*

>not_qual< Based on the answers you have given, your farm or ranch is not eligible for our project. However, you are still eligible for the drawing for a $100 treasury bond. We will notify the households that are awarded the bonds at the completion of the project. [*Sometime in 2002.*] Would you

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like to be included in the drawing? *[Farms/ranches eligible for the project are operations that: had annual sales of agricultural goods of $1,000 or more or were involved in a CRP during the past year; and were actively farming/ranching as of January 1st of this year or had land in CRP; and had a farm/ranch household.]*

1 Yes
3 No

"Thank you for your time and cooperation in answering these questions. GOOD-BYE."

[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (3) DID NOT QUALIFY.*]*

>not_qual2< Based on the answers you have given, your farm or ranch household is not eligible for our project. However, you are still eligible for the drawing for a $100 treasury bond. We will notify the households that are awarded the bonds at the completion of the project. [*Sometime in 2002.*] Would you like to be included in the drawing? *[Farmsiranches eligible for the project* are *operations that: had annual sales of agricultural goods of $1,000 or more or were involved in a CRP during the past year; were actively farming/ranching as of January 1st of this year or had land in CRP; and had a farm/ranch household that included children).*

1 Yes
3 No

"Thank you for your time and cooperation in answering these questions. GOOD-BYE."

[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (3) DID NOT QUALIFY.*]*

>drawing2< You are eligible for the drawing for a $100 treasury bond. We will notify the households that are awarded the bonds at the completion of the project. [*Sometime in 2002.*] Would you like to be included in the drawing?

1 Yes *(go to* ***>sign_off3<****)*
3 No *(go to* ***>sign_off3<****)*

>drawing3< You are eligible for the drawing for a $100 treasury bond. We will notify the households that are awarded the bonds at the completion of the project. [*Sometime in 2002.*] Would you like to be included in the drawing?

1 Yes *(go to* ***>sign_off2<****)*
3 No *(go to* ***>sign_off2<****)*

>sign_off2< Thank you for your time today. Good bye. [Programming Note: If >phone< is not blank, Call new telephone number/Restart interview.]

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[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (2) REFUSED.*]*

>sign_off3< *[Enumerator: If the respondent has already identified why he/she does not want to participate, just identify one or more of the following responses:]*

"Could you tell me the reason that you prefer not to participate in this interview?"

1 Does not want to cooperate; does not like surveys *(go to* ***>sign_rest<****)*
2 Too busy; refused to schedule a call-back *(go to* ***>sign_rest<****)*
3 Personal crisis; refused to schedule a call-back *(go to* ***>sign_rest<****)*
4 Other

>reason_specify< "Specify reason:"

_____

>sign_rest< "Thank you for your time today. Good bye."

[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (2) REFUSED.*]*

>callback< [Enumerator: Setup callback to a knowledgable individual. Press CONTROL-ENTER to go to the appointment block. Remember to record the appointment on the call sheet.]

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RRIS II: Agricultural Injury Surveillance

1 RO1 OH04270

First Six-Month Interview
(January 1 through June 30, 2001)

Administered by specially trained interviewers, using a Computer-Assisted Telephone Interview (CATI)

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Initial Programming Note: The following variables are brought forward from the participation interview:

>Resp_type< *(1 = Female head of household; 3 = Male head of household)*
>Resp_name< *(Participation interview respondent's name)*
>persons20< *(Number of persons 20 years of age and over as of January 1, 2001)*
>persons19< *(Number of persons 19 years of age and under as of January 1, 2001)*

-- Script Before Entering CATI Program –

Dial number from call sheet prepared by the USDA National Agricultural Statistics Service (NASS).

When someone answers the phone –

Ask:
"Hello, is this the _____ residence?"
If it is not the residence you are calling, follow standard NASS procedures verifying number, etc

If it's the correct household:
Ask: ***"May I please speak with the female head of household?"***
Female head of household comes to the phone (*continue interview*)

Female head of household is unavailable (*go to >callback<*)

There is no female head of household -
Ask: ***"Then, may I please speak to the male head of household?"***
Male head of household comes to the phone (*continue interview*)

Male head of household is unavailable (*go to >callback<*)
~~**Please enter a comment that there is no female head of household, so the enumerator who places the next call will know to ask for the male head of household.**~~

-- When an appropriate respondent (female or male head of household) has come to the phone begin the CATI interview --

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CATI Interview

Household Log Interview

>Who_Pi< *[Enumerator: Who is the current respondent? Enter name.]*

>Cur_Resp< **[Enumerator: Enter code.]**

1 Female head of household
3 Male head of household

>int_ProgNote< *[Programming Note:*
If >Cur_Resp< = >Resp_type< (from participation interview)
***>Who_Pi2<** = "you"*
***>he_she1<** = "you"*
Else
***>Who_Pi2<** =>Resp_name<*
If (>Resp_type< = 1)
***>he_she1<** = "she"*
Else
***>he_she1<** = "he"*
End If
End If]

>Intro< "Hello, this is >EnumName< calling for the >StateName< agricultural statistics service. I'm calling to follow up on a project we are conducting with the University of Minnesota about farming and ranching activities and injuries. The results from the project will be used to develop injury prevention programs that can benefit all households."

1 *Continue*

>Intrdctn< "When we spoke with >Who_Pi2< recently, >he_she1< said that you would be willing to help us with this project. We would like to conduct the full interview now, to obtain information about members of your household, your farming or ranching activities, and any injuries that may have occurred in the first six months of this year. All information we collect is confidential. If you are uncomfortable with any question, you may choose not to answer that question, and we will move on to the next question. Is this a convenient time?"

1 Yes *(go to **>cards<**)*
3 No, not a convenient time *(go to **>callback<**)*
9 Refusal *(go to **>reconsider1<**)*

>Monitoring< "For quality control purposes, my supervisor may monitor this call."

1 *Continue*

>cards< "After we spoke with >Who_Pi2<, we mailed you an interview

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information packet containing two letters and a set of colored cards. It would be helpful if you had the cards in front of you as we speak. Do you have them available?"

1 Yes *(go to >HH_totalA<)*
3 No *(go to >getcards<)*

>getcards< "Can you get the cards?"

1 Yes *(go to >HH_totalA<)*
3 No *(go to >proceed<)*

>proceed< "We can proceed with the interview anyway. May we continue?"

1 Yes *(go to >HH_totalA<)*
3 No (*go to >callback<*)

>HH_totalA< "Let me verify the number of people that lived in your household as of January 1, 2001. I have:

Persons 20 years of age and over: >persons20<

Persons 19 years of age and under: >persons19<.

Is this correct?"

1 Yes *(go to >hh_ProgNote1<)*
3 No *(go to >person20<)*

>person20< "How many persons in your household were 20 years of age or OLDER as of January 1, 2001? Remember, if someone is 20 today but their birthday was between January 1st and today, they were 19 on January 1st." *[Enumerator: If the respondent is uncertain, prompt them for their best estimate.]* ____

>person19< "How many persons in your household were 19 years of age or YOUNGER?"
[If respondent is uncertain, prompt them for their best estimate.] ____

>HH_totalB< "Let me verify the number of people that lived in your household as of January 1, 2001. I have:

Persons 20 years of age and over: >person20<

Persons 19 years of age and under: >person19<.

Is this correct?"

1 Yes *(go to >hh_ProgNote1<)*
3 No *(go to >person20<)*

>hh_ProgNote1< *[Programming Note:*

If (>HH_totalA< = 3)

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*>**persons20**< = >person20<*
*>**persons19**< = >person19<*
Endif
If (>persons19< = 0)
*Go to >**not_qual**<*
Else
*Go to >**enterpr1**<*
Endif]

>not_qual< "Since no one in your household was 19 years of age or younger, as of January 1, 2001, your household is not eligible for our project. However, you are still eligible for the drawing for a $100 U.S. Savings Bond (Series EE) that we told >Who_Pi2< about during our earlier conversation. Thank you for your time and cooperation. Goodbye."

1 *Continue (go to to **>hh_exit1<**)*

>enterpr1< "Between January 1 and June 30, 2001, of the following farming/ranching enterprises, which ONE required the MOST amount of WORK TIME on your operation?"

1 Beef cattle
2 Dairy cattle
3 Other animals (i.e. poultry, sheep, swine, horses, etc.)
4 Field, forage or specialty crops
5 CRP (Conservation Reserve Program) or Set-aside program
6 Other, specify_____
8 Unknown
9 Refused

>hh_ProgNote2< *[Programming Note: If >proceed< = 1 (go to **>hh_log<**); Else (go to **>get_gold<**)]*

>get_gold< "For the next questions it will be helpful for you to have the gold card from the packet in front of you. Do you have the gold card?" *(Wait for the respondent to get the gold card or say that it is not available.)*

1 *Continue*

>hh_log< "Now I need to collect some basic information about each member of your household. Starting with the persons 20 years of age and older (if there is one)...."

1 *Continue*

>hh_ProgNote3< *[Programming Note: Set **>kids<** = 0; **>adults<** = 0. Create array >kidmo(>persons19<,6)<, to represent the possible months for which "kids" can be either cases or controls and set all cells of the array to 0. The program then loops through the age groups. First Persons 20 and Over, person 0 thru >persons20< (**>type_pers<** = "adult" and **>adults<** = **>adults<** + 1, set **>kidno<** = 0, with ">type_pers< "#" >adults<" displayed in the upper left corner of the screen); then Persons 19 and Under, person 1 thru >persons19< (increment **>kids<** = **>kids<** + 1, set **>kidno<** = >kids<, with **>type_pers<** = "child",*

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">type_pers< "#" >kids<" displayed in the upper left corner of the screen). As it goes through the loop, each subject is also assigned an incremental subject number ***>noinfarm<****, and the total number of people in the farm household,* ***>totinfarm<*** *set to >persons20< + >persons19<.]*

>first_name< "What is their first name?" _____

>last_name< "What is >first_name<'s last name?" _____

>self_relat< "What is >first_name<'s relationship TO YOU?"

1 Self (respondent)
2 Spouse / Life partner
3 Child (son/daughter)
4 Sibling
5 Parent
6 Other family
7 Non-family
8 Unknown
9 Refused

>hh_ProgNote4< *[Programming note:*
>Was_is< *= "is"*
>Was_were< *= "was"*

If >self_relat< = 1
>Your_name's< *= "your"*
>Title< *= "you"*
>Was_were< *= "were"*
>hh_moved< = 1 (Yes)
If **>HHLog_resp< = 2** ***(Female Head of Household)***
>gender< *= 3 (female)*
Else
>gender< *= 1 (male)*
Endif
Go to ***>dob<***

Else

>Your_name's< *= ">first_name<'s"*
>Title< *= >first_name<*

Endif

Endif/

>hh_moved< "Did >first_name< live in your household as of JUNE 30, 2001?" *[Note: People on vacation on June 30, 2001 are considered to be living in the household.]*

1 Yes (*go to* ***>hh_ProgNote5a<***)
3 No (*go to* ***>hh_other<***)

>hh_other< "Did >first_name< move or pass away

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between January 1 and June 30, 2001?"

1 Moved – Includes those who left for school or to live in another household, whether temporarily or permanently. (*go to* ***>month_left<***)

2 Passed away *(go to* ***>hh_ProgNote5<****)*

3 Not living in Household at any time during this 6 months *(go to* ***>leadin<****)*

>hh_ProgNote5< *[Programming Note: If* ***>hh_other<*** *= 2 (deceased), set* ***>Was_is<*** *= "was"]*

>month_left< "In what month did this occur?" ____

>day_left< "On what day of the month?" ____

>leadin< "I'd like to ask you some questions about >first_name< even though he/she is not living with you now."

1 *Continue*

>gender< ">Was_is< >first_name< male or female?"

1 Male
1 Female

>dob< "What >was_is< >Your_name's< birthdate?"____/__/__ (YYYY/MM/DD)

>hh_ProgNote6< *[Programming note: If respondent does not know date of birth or refuses to give it, go to* ***>current<****; Else go to* ***>hh_ProgNote6a<****]*

>current< "What was >his_her< age on January 1, 2001?" __ Years

>hh_ProgNote6a< [Programming Note:
If (>type_pers< = "child")
>kid_num< = >kids<
Else
>kid_num< = 99
End If
If (>dob< known)
>age< = trunc((((01/01/2001) - >dob<])/365.25),0)
Else
>age< = >current<
End If

>hh_ProgNote6b< [Programming Note:: If **>self_relat<** = 1 and **>age<** < 18, print the following error message and schedule a callback to an adult. Error message:]

"Warning – According to the relationship and birthdate/age information you have entered the person you are interviewing is too young! Please correct this information if it is in error, or explain that we cannot

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interview individuals who were under 18 years of age (as of January 1st) without prior parental permission and schedule a callback." *(go to **>dob<**)*

>hh_ProgNote6c< [Programming Note:: Don't collect information on individuals born after January 1st, 2001: If >age< < 0 (born in 2001), verify **>dob<**. If birthdate is before 01/01/2001 go to **>race<**, ELSE go to **>hh_next_member<**.]]

>race< "What >was_is< >Your_name's< race?)" *[Enumerator: Read list and enter ALL that apply]*

1 White
2 Black or African American
3 American Indian or Alaskan Native
4 Hispanic or Latino
5 Asian
6 Native Hawaiian or Pacific Islander
7 Something else
8 Unknown
9 Refused

>hh_ProgNote7< *[Programming note: If any of the codes entered in >race< is 7, go to **>race_specify<**; else go to **>hh_ProgNote8<**]*

>race_specify< "Please specify the other race." _____

>hh_ProgNote8< *[Programming note:*

If (>hh_other< = 3)
*Go to **<hh_next_member<***
Elseif (>age< < 16)
*Go to **>insurance<***
Endif]

>married< "As of January 1, 2001, what was >Your_name's< marital status?"

1 Married or living as married
2 Never married
3 Separated
4 Divorced
5 Widowed
8 Unknown
9 Refused

>insurance< "From January 1, 2001 through June 30, 2001, >was_were< >Title< covered by any type of health or medical insurance, including Medicare or Medicaid?"

1 Yes, all of that time *(go to **>type_ins<**)*
3 Yes, part of that time *(go to **>type_ins<**)*
5 No, none of that time *(go to **>yrs_school<**)*
8 Unknown *(go to **>yrs_school<**)*
9 Refused *(go to **>yrs_school<**)*

>type_ins< "Under which of the following types >was_were< >Title< covered?" *[Enumerator: Read list and enter ALL that apply.]*

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1 Employer provided (paid) medical plan
2 Household provided (paid) medical plan
3 Medicare with a supplemental policy
4 Medicare without a supplemental policy
5 Medicaid
6 Something else
8 Unknown
9 Refused

>hh_ProgNote9< *[Programming note: If any of the codes entered in >type_ins< is 6, go to **>type_ins_specify<**; else go to **>hh_ProgNote10<**]*

>type_ins_specify< "Please specify the other insurance."

_____

>hh_ProgNote10< *[Programming note: If household member you're asking about is < 5 years of age, go to **>mo_farmwork6<**]*

>yrs_school< "As of January 1, 2001, what was the highest grade in school >Title< completed?"

0 Less than kindergarten (includes pre-school & no school) *(go to **>mo_farmwork6<**)*
1 Eighth grade or less (includes kindergarten) *(go to **>mo_farmwork6<**)*
2 Some high school *(go to **>mo_farmwork6<**)*
3 High school graduate or GED *(go to **>mo_farmwork6<**)*
4 Some technical school *(go to **>mo_farmwork6<**)*
5 Technical school graduate *(go to **>mo_farmwork6<**)*
6 Some college *(go to **>mo_farmwork6<**)*
7 College graduate *(go to **>mo_farmwork6<**)*
8 Post graduate/Professional school (graduate school, medicine, law, etc.) *(go to **>mo_farmwork6<**)*
9 Other *(go to **>yrs_school_specify<**)*
98 Unknown *(go to **>mo_farmwork6<**)*
99 Refused *(go to **>mo_farmwork6<**)*

>yrs_school_specify< "Please specify the other schooling."

_____

>mo_farmwork6< "Between January 1, 2001 and June 30, 2001, how many months did >Title< work or do chores in any activity related to your farming or ranching operation?"

0 None *(go to **>hh_next_member<**)*
___ 1 – 6 months
8 Unknown
9 Refused

>hrs_farmwork6< "On average, how many HOURS PER WEEK?"

___ 1 – 130 hours
998 Unknown
999 Refused

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>hh_next_member< *[Programming note: Remove individuals < 20 as possible controls for month when they were not in residence:*

If (>type_pers< = "child")
If (>hh_other< = 3)
*I=1,6: **>kidmo(>kids<,i)**< = 9*
Elseif (>month_left< ge 1 and >month_left< < 6)
*I=>month_left<+1,6: **>kidmo(>kids<,i)**< = 9 Endif*

*Then, if no more HH members remain - go to **>cards2c**< else **continue]***

"Now, let's talk about the next member of your household."

1 *go to **>hh_ProgNote3**<*

>reconsider1< "May I ask why you prefer not to continue at this time?"

1 Operation too small *(go to **>reconsider3**<)*
2 Didn't have any injuries *(go to **>reconsider2**<)*
3 Haven't been farming long enough *(go to **>reconsider3**<)*
4 Not a convenient time – Too busy (*go to **>callback**<*)
5 Personal crisis (*go to **>callback**<*)
6 Does not want to cooperate (Doesn't like surveys) – Just not interested *(go to **>reconsider3**<)*

>reconsider2< "Your participation will be very important in efforts to reduce farming and ranching accidents and injuries for ALL farm families. It is important to include ALL types of operations, whether or not there were accidents or injuries. This will help in better understanding both farming and ranching activities, and injuries in your region. Would you reconsider participating?"

1 Yes *(go to **>cards**<)*
3 Not a convenient time – Too busy (*go to **>callback**<*)
5 No, don't want to participate *(go to **>abbrev1**<)*

>reconsider3< "The results of this project will be used to develop effective injury prevention programs that can benefit all farming and ranching households. When we spoke with >Who_Pi2< earlier >he_she1< agreed to participate in the project. Your participation is very important. Would you please reconsider?"

1 Yes *(go to **>cards**<)*
3 Not a convenient time – Too busy (*go to **>callback**<*)
5 No, don't want to participate *(go to **>abbrev1**<)*

>abbrev1< "In that case, would you consider answering a few brief questions about the members of your household and any injuries that occurred between January 1, and June 30, 2001?"

1 Yes *(go to **>ab_acres**<)*
3 No *(go to **>hh_end1**<)*

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Abbreviated Interview

>ab_acres< "The first set of questions are about YOUR farming or ranching operation.

Between January 1st, 2001 and June 30th, 2001, of the acres that you own, plus the acres that you rent or lease, how many did you have in use or active production, including land in hay and pasture? Do not include wasteland, woodlands, or land in long-term CRP (Conservation Reserve Programs) or any set-aside programs."

0-99,999 acres *[Enumerator: Note - If >0 & <1, code as 1]*

>ab_enterpr< "During that time, of the following farming/ranching enterprises, which ONE required the most amount of WORK TIME on your operation?"
[Enumerator: Read list of possible answers.]

1 Beef cattle *(go to **>ab_HH_totalA<**)*
2 Dairy cattle *(go to **>ab_HH_totalA<**)*
3 Other animals (i.e. poultry, sheep, swine, horses, etc.) *(go to **>ab_HH_totalA<**)*
4 Field, forage or specialty crops *(go to **>ab_HH_totalA<**)*
5 CRP (Conservation Reserve Program) or Set-aside program *(go to **>ab_HH_totalA<**)*
6 Other *(go to **>ab_enterpr_specify<**)*
8 Unknown *(go to **>ab_HH_totalA<**)*
9 Refused *(go to **>ab_HH_totalA<**)*

>ab_enterpr_specify< "Please specify other enterprise." _____

>ab_HH_totalA< "Let me verify the number of people that lived in your household as of January 1, 2001. I have:

Persons 20 years of age and over: >persons20<

Persons 19 years of age and under: >persons19<.

Is this correct?"

1 Yes *(go to **>ab_ProgNote1<**)*
3 No *(go to **>ab_person20<**)*

>ab_person20< "How many persons in your household were 20 years of age or OLDER as of January 1, 2001? Remember, if someone is 20 today but their birthday was between January 1st and today, they were 19 on January 1st." *[Enumerator: If the respondent is uncertain, prompt them for their best estimate.]* ____

>ab_person19< "How many persons in your household were 19 years of age or YOUNGER?"
[If respondent is uncertain, prompt them for their best estimate.] ____

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>ab_HH_totalB< "Let me verify the number of people that lived in your household as of January 1, 2001. I have:

Persons 20 years of age and over: >ab_person20<

Persons 19 years of age and under: >ab_person19<.

Is this correct?"

1 Yes *(go to **>ab_ProgNote1<**)*

3 No *(go to **>ab_person20<**)*

>ab_ProgNote1< *[Programming Note:*

If (>ab_HH_totalA< = 3)
>persons20< = >ab_person20<
>persons19< = >ab_person19<
Endif
If (>persons19< = 0)
*Go to **>ab_not_qual<***
Else
*Go to **>ab_farminja<***
Endif]

>ab_not_qual< "Since no one in your household was 19 years of age or younger, as of January 1, 2001, your household is not eligible for our project. However, you are still eligible for the drawing for a $100 U.S. Savings Bond (Series EE) that we told >Who_Pi2< about during our earlier conversation. Thank you for your time and cooperation. Goodbye."

1 *Continue to **>ab_exit1<***

>ab_farminja< "Next I will be asking a few questions about each member of your household and any injury events they may have experienced. By injury we mean any accident or injury event that:

[READ SLOWLY!!]

- Restricted normal activities for at least 4 hours;

AND/OR

- Resulted in loss of consciousness, loss of awareness, or amnesia for any length of time;

AND/OR"

1 *Continue*

>ab_farminjb< "• Required professional health care, including doctors, nurses, chiropractors, dentists, or other health care professionals.

This includes accidents or injuries that:

1) Happened ON OR OFF THE FARM OR RANCH; and

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2) Were minor, serious or fatal."

1 *Continue*

>ab_farminjc< "Some examples of injuries include:

- A twisted ankle or broken leg;
- Briefly passing out while pouring chemicals;
- An animal bite or kick;
- A blow to the head or other part of the body."

1 *Continue*

>ab_farminj< "Thinking about the time between January 1st and June 30th, 2001, did any member of your household have any accidents or injuries in any way related to YOUR farming or ranching operation? This includes activities such as transportation on roadways, or any other aspect of your operation, including raising animals for recreation or home use. It could also include someone who was injured while standing or playing in an area where these activities were taking place."

1 Yes
3 No
8 Unknown
9 Refusal

>ab_non_farminj< "During that time, did any member of your household have any accidents or injuries related to activities OTHER THAN farming or ranching?"

1 Yes
3 No
8 Unknown
9 Refusal

>ab_ProgNote2< *[Programming note: If* ***>ab_farminj<*** *= 3 (no) and* ***>ab_non_farminj<*** *= 3 (no), go to* ***>ab_end2<****]*

>ab_ProgNote3< *[Programming Note: The program loops through the age groups. First Persons 20 and Over, person 0 thru >persons20< (****>type_pers<*** *= "adult" and* ***>adults<*** *=* ***>adults<*** *+ 1, with ">type_pers< "#" >adults<" displayed in the upper left corner of the screen); then Persons 19 and Under, person 1 thru >persons19< (increment* ***>kids<*** *=* ***>kids<*** *+ 1, with* ***>type_pers<*** *= "child", ">type_pers< "#" >kids<" displayed in the upper left corner of the screen. If male,* ***>he_she<*** *= "he",* ***>his_her<*** *= "his"; else if female,* ***>he_she<*** *= "she",* ***>his_her<*** *= "her".]*

>ab_hh_log< "Now I need to collect some basic information about each member of your household. Starting with the persons 20 years of age and older (if there is one)...."

1 *Continue*

>gender< "Is" >type_pers< "#" >adults< (or >type_pers< "#" >kids<,

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from upper left corner of the screen) "male or female?"

1 Male
2 Female

>ab_ProgNote3a< *[Programming Note:*

If (>gender< = 1 (male)
>he_she< = "he"
>his_her< = "his"
Else if (>gender< = 2 (female)
>he_she< = "she"
>his_her< = "her"
Endif]

>ab_age< "What was >his_her< age as of January 1, 2001?" __ Years. *[Enumerator: If <1, enter 0.]*

>ab_ProgNote4< *[Programming Note: If >ab_farminj< = 3 (no), go to **>ab_ProgNote5<**.]*

>ab_farm< "Between January 1st and June 30th, 2001, did >he_she< have any accidents or injuries related to YOUR operation?"

1 Yes
3 No *(go to **>ab_ProgNote5<**)*
8 Unknown *(go to **>ab_ProgNote5<**)*
9 Refused *(go to **>ab_ProgNote5<**)*

>ab_num1< "How many?"

__ 1-9
98 Unknown
99 Refused

>ab_wk6< "During those months, how many months did >he_she< work or do chores in any activity related to your farming or ranching operation?"

0 None *(go to **>ab_ProgNote5<**)*
___ 1 – 6 months
8 Unknown *(go to **>ab_ProgNote5<**)*
9 Refused *(go to **>ab_ProgNote5<**)*

>ab_hr6< "On average, how many HOURS PER WEEK?"

____ 1-130 hr/wk
998 Unknown
999 Refused

>ab_ProgNote5< *[Programming Note: If >ab_non_farminj< = 3 (no), go to **>ab_next_member<**.]*

>ab_nonfarm< "During those months did >he_she< have any accidents or injuries related to activities OTHER THAN farming or ranching?"

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1 Yes
3 No *(go to **>ab_next_member<**)*
8 Unknown *(go to **>ab_next_member <**)*
9 Refused *(go to **>ab_next_member <**)*

>ab_num2< "How many?"

__ 1-9
98 Unknown
99 Refused

>ab_next_member< *[Programming note: If no more HH members remain - go to **>ab_end2<**; else **continue**]*

"Now, let's talk about the next member of your household."

*1 go to **>ab_ProgNote3<***

Injury Section

>i_ProgNote0< *[Programming Note: Carry forward: >persons19< and Array >kidmo(>persons19<,6)<; Set:*

>finj_kids< = 0 (# children with injuries associated with their farming/ranching operation)
Loop j = 1, >persons19<
>no_f_inj(j)< = 0 (# injuries assoc with their farming/ranching operation, for each child)
Continue

>cards2c< "The light blue card in your packet also defines what we mean by INJURY and will be helpful for the next few questions. Do you have the packet in front of you?"

1 Yes *(go to **>cards2a<**)*
3 No

>getcard< "Can you get the card?"

1 Yes
3 No

>cards2a< "The next questions are about accidents and injuries that occurred TO MEMBERS OF YOUR HOUSEHOLD BETWEEN JANUARY 1st AND JUNE 30th OF THIS YEAR. These may have resulted from activities related to farming or ranching, AS WELL AS from other activities NOT related to farming or ranching."

"The injured person could have been directly involved in the activities or simply standing or playing in the area. These accidents and injuries INCLUDE MINOR AS WELL AS SERIOUS AND FATAL ACCIDENTS OR INJURIES that:"

1 *Continue*

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>card2b< *[Enumerator: Read slowly!!]*

- **"Restricted normal activities for at least 4 hours;**

  AND/OR

- **Resulted in loss of consciousness, loss of awareness, or amnesia for any length of time;**

  AND/OR

- **Required professional healthcare, including care by doctors, nurses, chiropractors, dentists or other healthcare professionals."**

1 Continue

>i_ProgNote1< *[Programming Note: If >cards2c< = 1 (yes) or >getcard< = 1 (yes) go to* ***>questions<****, else, go to* ***>nocard1<****]*

>nocard1< "Let me give you a few examples of the types of injuries we're interested in. These include:

- A brain injury or loss of consciousness resulting from a fall;
- A broken arm from working with machinery;
- An animal bite or kick;
- A brief loss of consciousness after breathing toxic gas such as silo gas or manure pit gas;
- A burn or blister due to heat or chemical contact;"

1 *Continue*

>nocard2<

- "Abdominal injuries resulting from a motor vehicle crash;
- A leg fracture from a sports or recreation activity;
- A strained/pulled back from lifting, twisting, etc.;
- A cut or laceration from working with a tool;
- A bruise or contusion from a falling item or being struck by or against equipment or an animal."

"Do you have questions about the type of injuries we're interested in?"

1 Yes *[Enumeratror: Answer questions and repeat description, as necessary, then go to* ***>i_next_member<****]*
3 No *(go to* ***>i_next_member<****)*

>questions< "Do you have any questions about the types of injuries we're interested in?"

1 Yes *(go to* ***>nocard1<****)*
3 No

>i_next_member< *[Programming Note: The program loops through the study subjects , for*

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*>noinfarm< = 1 to >totinfarm<; Then go to **>e_ProgNote1<**. Identifiers carried forward for each member from the Household Log are* >first_name<, >self_relat<, >hh_other<, >gender<, >kidno<, and >age<*]*

>i_ProgNote1a< *[Programming Note:*

If (>age< < 0 (born after 01/01/2001))
*Go to **>i_next_member<***
Else if **(>self_relat< = 1)**
***>Your_name's<** = "your"*
>Title<** = "you" **(Always inserting >first_name<)
***>Was_were<** = "were"*
>He_she<** = "you" **(Always inserting "he" "she")
***>Are_is<** = "Are"*
***>Have_has<** = "have"*
***>His_her<** = "your"*
Else
***>Your_name's<** = ">first_name<s"*
***>Title<** = >first_name<*
***>Was_were<** = "was"*
***>Are_is<** = "Is"*
***>Have_has<** = "has"*
If (>gender< = 1)
***>He_she<** = "he"*
***>His_her<** = "his"*
Else if (>gender< = 3)
***>He_she<** = "she"*
***>His_her<** = "her"*
Else
***>Are_is<** = "Are"*
***>He_she<** = "they"*
***>His_her<** = "their"*
Endif
Endif]

>prior_injury1< "At any time PRIOR to January 1st, 2001, did >Title< EVER have any type of farming/ranching-related accidents or injuries?"

1	Yes	8	Unknown *(go to **>i_ProgNote1b<**)*
3	No *(go to **>i_ProgNote1b<**)*	9	Refused *(go to **>i_ProgNote1b<**)*

>prior_injnumber< "How many injuries or accidents did >Title< have?"

___	1-20
98	Unknown
99	Refused

>prior_loss1< "Did this injury (any of these injuries) result in permanent disabilities? This includes the loss of a body part or other disfigurement, permanent pain or discomfort, or restricted activity."

Refused *(go to **>ab_next_member <**)*

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>i_ProgNote1b< *[Programming Note: If (>hh_other< = 3 (not in household during 6 month period), Go to **>i_next_member<**; Else - Go to **>inj_log<**]*

>inj_log< "DURING THE SIXTH MONTH PERIOD, BETWEEN JANUARY 1 AND JUNE 30, 2001, Did >Title< have ANY type of accidents or injuries?"

1 Yes
3 No *(go to **>i_next_member<**)*
8 Unknown *(go to **>i_next_member<**)*
9 Refused *(go to **>i_next_member<**)*

>inj_farmop< "During that time, how many accidents or injuries did >Title< have, that were in any way related to YOUR farming or ranching operation? This includes activities such as transportation on roadways, or any other aspect of your operation, including raising animals for recreation or home use? It could also include someone who was injured while standing or playing in an area where these activities were taking place." [*Enumerator: Do not include bookwork, housework, or house repairs.*]

__ 0-5
8 Unknown
9 Refused

>inj_othrfarm< "How many accidents or injuries did >Title< have, related to SOMEONE ELSE'S farming or ranching operation?"

__ 0-5
8 Unknown
9 Refused

>inj_nonfarmop< "How many accidents or injuries did >Title< have, that were related to activities OTHER THAN farming or ranching?"

__ 0-5
8 Unknown
9 Refused

>i_ProgNote2< *[Programming Note: Set **>total_injuries<** = >inj_farmop< + >inj_othrfarm< + >inj_nonfarmop<]*

>verify_inj< "So >Title< had >total_injuries< injuries total, from January 1, 2001 to June 30, 2001.

>inj_farmop< - Related to your operation.

>inj_othrfarm< - Related to someone else's Operation /.

>inj_nonfarmop< - Related to Activities other than farming or ranching.

Is this correct?"

1 Yes
3 No *(go to **>inj_farmop<**)*

>i_next_event< *[Programming Note: The interview first loops through all injuriy*

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events related to their own farming or ranching operation, ***>type_inj<*** *= "On your own operation – injury #",* ***>iinj<*** *= 0 to >inj_farmop<; Then the interview loops through all injury events related to someone else's farming or ranching operation,* ***>type_inj<*** *= "On someone elses operation – injury #",* ***>iinj<*** *= 0 to >inj_othrfarm<; Then the interview loops through all injury events related to something other than farming or ranching,* ***>type_inj<*** *= "Activities other than farm/ranch – injury #",* ***>iinj<*** *= 0 to >inj_nonfarmop<*

>inj_where< "Referring to >type_inj<>iinj<, where did the accident or injury happen?"

1 Around the farm or ranch *(go to* ***>inj_source1<****)*
2 Roadway (farm/ranch operation road or public road) *(go to* ***>inj_source1<****)*
3 In or around the house *(go to* ***>inj_source1<****)*
4 Sports or recreation area *(go to* ***>inj_source1<****)*
5 Work (other than on the farm or ranch) *(go to* ***>inj_source1<****)*
6 School *(go to* ***>inj_source1<****)*
7 Public place (restaurant or other public place) *(go to* ***>inj_source1<****)*
8 Someone else's house *(go to* ***>inj_source1<****)*
9 Someone else's farm or ranch *(go to* ***>inj_source1<****)*
10 Other
11 Public outdoor area NEC (park, lake...) *(go to* ***>inj_source1<****)*
12 Cabin/operator owned vacation property *(go to* ***>inj_source1<****)*
98 Unknown *(go to* ***>inj_source1<****)*
99 Refused *(go to* ***>inj_source1<****)*

>inj_where_specify< "Specify the place."

_____

>inj_source1< "Which of the following SOURCES were involved in the accident/injury? I need to read the entire list before you give me your answer. After I read the list, please tell me the one or two sources that were most directly involved in causing the accident:

1 Tractor
2 Motor Vehicle
3 Other Large machinery/ Equip
4 Sm. power equip/hand tools
5 Livestock or animals, including insects
6 Storage structures
7 Chemicals/drugs/ medications/Bio-aerosols
8 Body of water
9 Falls / Surfaces
10 Sports / Recreation
11 Housework
12 Yardwork/gardening
13 Work related (nonfarm)
14 Something else (physical object)
15 General Activity"
16 None - No secondary source
98 Unknown
99 Refused

>i_ProgNote3< *[Programming Note: Set* ***>Src_Cnt<*** *= 1<, go to* ***>i_ProgNote4<****]*

>inj_source2< "Referring to >type_inj<>iinj<:

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Were any of the other sources that I read to you involved in the accident/injury?"

1 Tractor
2 Motor Vehicle
3 Other Large machinery/ Equip
4 Sm. power equip/hand tools
5 Livestock or animals, including insects
6 Storage structures
7 Chemicals/drugs/ medications/Bio-aerosols
8 Body of water
9 Falls / Surfaces
10 Sports / Recreation
11 Housework
12 Yardwork/gardening
13 Work related (nonfarm)
14 Something else (physical object)
15 General Activity"
16 None - No secondary source *(go to **>inj_activity<**)*
98 Unknown *(go to **>inj_activity<**)*
99 Refused *(go to **>inj_activity<**)*

>i_ProgNote4< *[Programming Note: If((>inj_source1< = 1 and >Src_Cnt< = 1) or (>inj_source2< = 1 and >Src_Cnt< = 2)), go to **>inj_tractor<**, else go to **>i_ProgNote5<**]*

>inj_tractor< "Was the tractor A LARGE TRACTOR WITH MORE THAN 20 HORSEPOWER, A SMALL TRACTOR WITH LESS THAN OR EQUAL TO 20 HORSEPOWER, OR A SKID/STEER TRACTOR (I.E. BOBCAT)?"

1 Tractor more than 20 HP *(call **Subroutine PTO**)*
2 Tractor less than or equal to 20 HP (i.e. garden tractor) *(call **Subroutine PTO**)*
3 A skid steer tractor (e.g., Bobcat) *(go to **>i_ProgNote5<**)*
8 Unknown *(go to **>i_ProgNote5<**)*
9 Refusal *(go to **>i_ProgNote5<**)*

Subroutine PTO

>inj_PTO< "Was a POWER-TAKE-OFF (PTO) involved in the accident?"

1 Yes *(go to **>inj_shield<**)*
3 No *(return)*
8 Unknown *(go to **>i_ProgNote5<**)*
9 Refused *(go to **>i_ProgNote5<**)*

>inj_shield< "Was the PTO SHIELDED?"

1 Yes
3 No
8 Unknown
9 Refused

RETURN

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>i_ProgNote5< *[Programming Note: If((>inj_source1< = 2 and >Src_Cnt< = 1) or (>inj_source2< = 2 and >Src_Cnt< = 2)), go to **>inj_motorveh<**, else go to **>i_ProgNote6<**]*

>inj_motorveh< "What TYPE OF MOTOR VEHICLE was involved in the accident?"

1 Car *(go to **>i_ProgNote6<**)*
2 Van *(go to **>i_ProgNote6<**)*
3 Sport utility vehicle *(go to **>i_ProgNote6<**)*
4 Pickup truck *(go to **>i_ProgNote6<**)*
5 Grain truck *(go to **>i_ProgNote6<**)*
6 Other truck *(go to **>i_ProgNote6<**)*
7 Motorcycle or motor bike *(go to **>i_ProgNote6<**)*
8 All terrain vehicle: ATV *(go to **>i_ProgNote6<**)*
9 Snowmobile *(go to **>i_ProgNote6<**)*
10 Personal watercraft (i.e. Ski-doo) *(go to **>i_ProgNote6<**)*
11 Other
12 Bicycle *(go to **>i_ProgNote6<**)*
13 School bus *(go to **>i_ProgNote6<**)*
14 Golf cart *(go to **>i_ProgNote6<**)*
15 Go cart *(go to **>i_ProgNote6<**)*
16 Truck NOS *(go to **>i_ProgNote6<**)*
17 Railroad car *(go to **>i_ProgNote6<**)*
98 Unknown *(go to **>i_ProgNote6<**)*
99 Refused *(go to **>i_ProgNote6<**)*

>inj_motorveh_specify< "Please specify the type of motor vehicle." _____

>i_ProgNote6< *[Programming Note: If((>inj_source1< = 3 and >Src_Cnt< = 1) or (>inj_source2< = 3 and >Src_Cnt< = 2)), go to **>inj_largemach$_i$<**, else go to **>i_ProgNote7<**]*

>inj_largemach$_i$< "In the following list of large machinery or equipment, WHAT TYPE OR TYPES were involved in the accident? I need to read the entire list before you give me your answer." *[Enumerator Note: "involved" means the equipment/vehicle the person was operating/riding in or on, or the person was a bystander.]*

01 "Tillage equipment (Disc, moldboard plow, field cultivator, chisel plow, rotary hoe, row crop cultivator, powered tiller, cultipacker, etc.)" *(go to **>i_ProgNote6a<**)*
02 "Planting equipment (i.e. planters, drills, etc.)" *(go to **>i_ProgNote6a<**)*
03 "Harvesting equipment (Combines, pickers, forage harvesters, mowers balers, stackers, specialty harvesters, etc.)" *(go to **>i_ProgNote6a<**)*
04 "Augers / Elevators (Portable and fixed augers, elevators or conveyors)" *(go to **>i_ProgNote6a<**)*
05 "Feed grinder / mixer" *(go to **>i_ProgNote6a<**)*
06 "Irrigation equipment" *(go to **>i_ProgNote6a<**)*
07 "Wagons / Trailers (hay racks, forage wagons, gravity box, graincart, etc.)" *(go to*

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>i_ProgNote6a<)

08 "Chemical and fertilizer application equipment" *(go to >i_ProgNote6a<)*
09 "Manure application equipment" *(go to >i_ProgNote6a<)*
10 "Other farm equipment; **powered by an external source** (silage / forage blowers, grain dryers, etc.)" *(go to >i_ProgNote6a<)*
11 "Other farm equipment; **self-powered** (Back-hoe, Caterpillar, forklift, earthmoving equipment, etc.)" *(go to >i_ProgNote6a<)*
12 "Milking equipment" *(go to >i_ProgNote6a<)*
13 "Riding lawn mower" *(go to >i_ProgNote6a<)*
14 "Other powered equipmen"
00 No more machinery involved in accident *(go to >i_ProgNote6a<)*
98 Unknown *(go to >i_ProgNote6a<)*
99 Refusal *(go to >i_ProgNote6a<)*

>inj_lgmach_specify< "Please specify the type of large machinery." _____

>i_ProgNote6a< *[Programming Note: If ((>inj_largemach$_1$< ge 1 and >inj_largemach$_1$< le 5) or (>inj_largemach$_1$< ge 8 and >inj_largemach$_1$< le 10) or (>inj_largemach$_2$< ge 1 and >inj_largemach$_2$< le 5) or (>inj_largemach$_2$< ge 8 and >inj_largemach$_2$< le 10) or (>inj_largemach$_3$< ge 1 and >inj_largemach$_3$< le 5) or (>inj_largemach$_3$< ge 8 and >inj_largemach$_3$< le 10) or (>inj_largemach$_4$< ge 1 and >inj_largemach$_4$< le 5) or (>inj_largemach$_4$< ge 8 and >inj_largemach$_4$< le 10) or (>inj_largemach$_5$< ge 1 and >inj_largemach$_5$< le 5) or (>inj_largemach$_5$< ge 8 and >inj_largemach$_5$< le 10)) call **Subroutine PTO]***

>i_ProgNote7< *[Programming Note: If((>inj_source1< = 4 and >Src_Cnt< = 1) or (>inj_source2< = 4 and >Src_Cnt< = 2)), go to **>inj_smequip<**, else go to **>i_ProgNote8<]***

>inj_smequip< "What TYPE OF SMALL EQUIPMENT OR HAND TOOLS were involved in the accident?"

1 Stationary powered shop tools(table saw, drill press, etc.) *(go to >i_ProgNote8<)*
2 Portable powered hand tool (portable saw or drill, electric screw driver, etc.) *(go to >i_ProgNote8<)*
3 Hand tool (hammer, chisel, saw, etc.) *(go to >i_ProgNote8<)*
4 Chain saw *(go to >i_ProgNote8<)*
5 Portable grinder *(go to >i_ProgNote8<)*
6 Stationary grinder *(go to >i_ProgNote8<)*
7 Lawn mower *(go to >i_ProgNote8<)*
8 Snow blower *(go to >i_ProgNote8<)*
9 Garden tiller *(go to >i_ProgNote8<)*
10 Syringe/vaccination needle *(go to >i_ProgNote8<)*
11 Post-hole digger/driver *(go to >i_ProgNote8<)*
12 Grinder NOS *(go to >i_ProgNote8<)*
13 Other
98 Unknown *(go to >i_ProgNote8<)*
99 Refusal *(go to >i_ProgNote8<)*

>inj_smequip_specify< "Please specify the type of small equipment." _____

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>i_ProgNote8< *[Programming Note: If((>inj_source1< = 5 and >Src_Cnt< = 1) or (>inj_source2< = 5 and >Src_Cnt< = 2)), go to* ***>inj_animals<****, else go to* ***>i_ProgNote9<****]*

>inj_animals< "What TYPE OF LIVESTOCK OR OTHER ANIMALS were involved in the accident?"

1 Dairy cow with newborn calf *(go to* ***>i_ProgNote9<****)*
2 Dairy cow or heifer *(go to* ***>i_ProgNote9<****)*
3 Dairy bull *(go to* ***>i_ProgNote9<****)*
4 Dairy calf *(go to* ***>i_ProgNote9<****)*
5 Beef cow with newborn calf *(go to* ***>i_ProgNote9<****)*
6 Beef cow, steer or heifer *(go to* ***>i_ProgNote9<****)*
7 Beef bull *(go to* ***>i_ProgNote9<****)*
8 Beef calf *(go to* ***>i_ProgNote9<****)*
9 Sow with piglets *(go to* ***>i_ProgNote9<****)*
10 Sow without piglets / Gilt *(go to* ***>i_ProgNote9<****)*
11 Feeder pig *(go to* ***>i_ProgNote9<****)*
12 Boar *(go to* ***>i_ProgNote9<****)*
13 Poultry *(go to* ***>i_ProgNote9<****)*
14 Sheep *(go to* ***>i_ProgNote9<****)*
15 Horse *(go to* ***>i_ProgNote9<****)*
16 Stud horse / Stallion *(go to* ***>i_ProgNote9<****)*
17 Dairy, unspecified/unknown *(go to* ***>i_ProgNote9<****)*
18 Beef, unspecified/unknown *(go to* ***>i_ProgNote9<****)*
19 Swine/Hogs unspecified/unknown *(go to* ***>i_ProgNote9<****)*
20 Cow, unspecified/unknown *(go to* ***>i_ProgNote9<****)*
21 Calf, unspecified/unknown *(go to* ***>i_ProgNote9<****)*
22 Bull, unspecified/unknown *(go to* ***>i_ProgNote9<****)*
23 Cattle, unspecified/unknown *(go to* ***>i_ProgNote9<****)*
24 Dog *(go to* ***>i_ProgNote9<****)*
25 Cat *(go to* ***>i_ProgNote9<****)*
26 Insect (Tick, bee, spider...) *(go to* ***>i_ProgNote9<****)*
27 Deer *(go to* ***>i_ProgNote9<****)*
28 Other
98 Unknown *(go to* ***>i_ProgNote9<****)*
99 Refusal *(go to* ***>i_ProgNote9<****)*

>inj_animals_specify< "Please specify the type of livestock." _____

>i_ProgNote9< *[Programming Note: If((>inj_source1< = 6 and >Src_Cnt< = 1) or (>inj_source2< = 6 and >Src_Cnt< = 2)), go to* ***>inj_storage<****, else go to* ***>i_ProgNote9<****]*

>inj_storage< "What KIND OF STORAGE STRUCTURE was it?"

1 Feed container / feed bunk *(go to* ***>i_ProgNote10<****)*
2 Livestock barn / Barn *(go to* ***>i_ProgNote10<****)*
3 Grain bin / granary *(go to* ***>i_ProgNote10<****)*
4 Corn crib *(go to* ***>i_ProgNote10<****)*

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5 Silo *(go to >i_ProgNote10<)*
6 Machine shed *(go to >i_ProgNote10<)*
7 Garage *(go to >i_ProgNote10<)*
8 Workshop / tool shed / shed *(go to >i_ProgNote10<)*
9 Manure pit / tank *(go to >i_ProgNote10<)*
10 Fruit or other non-grain crop storage *(go to >i_ProgNote10<)*
11 Other
98 Unknown *(go to >i_ProgNote10<)*
99 Refusal *(go to >i_ProgNote10<)*

>inj_storage_specify< "Please specify the kind of storage structure." _____

>i_ProgNote10< *[Programming Note: If((>inj_source1< = 7 and >Src_Cnt< = 1) or (>inj_source2< = 7 and >Src_Cnt< = 2)), go to >inj_chemical<, else go to >i_ProgNote11<]*

>inj_chemical< "What TYPE OF CHEMICALS, DRUGS OR MEDICATIONS were involved in the accident?"

1 Pesticides including: insecticides, herbicides, fungicides and fumigants *(go to >inj_pesticide<)*
2 Anhydrous ammonia *(go to >inj_pesticide<)*
3 Fuels, lubricants or cleaning agents *(go to >inj_pesticide<)*
4 Other chemical products, such as household products, paint, solvents, etc. *(go to >i_ProgNote11<)*
5 Veterinary medicines *(go to >i_ProgNote11<)*
6 Bio-aerosols & Plant toxins (Such as molds, funguses, etc.) *(go to >i_ProgNote11<)*
7 Other
8 Unknown *(go to >i_ProgNote11<)*
9 Refusal *(go to >i_ProgNote11<)*

>inj_chemical_specify< "Specify the type and name." _____ *(go to >i_ProgNote11<)*

>inj_pesticide< "Was the chemical or pesticide STORED IN A CONTAINER LABELED WITH THE SIGNAL WORD 'DANGER' OR 'WARNING'?"

1 Yes 8 YYes 8 Unknown
3 No 9 No 9 Refusal

>i_ProgNote11< *[Programming Note: If((>inj_source1< = 8 and >Src_Cnt< = 1) or (>inj_source2< = 8 and >Src_Cnt< = 2)), go to >inj_water<, else go to >i_ProgNote12<]*

>inj_water< "What TYPE OF BODY OF WATER was involved in the accident?"

1 Lake *(go to >i_ProgNote12<)*
2 River, stream, or creek *(go to >i_ProgNote12<)*
3 Swamp *(go to >i_ProgNote12<)*
4 Pond (including stock pond) *(go to >i_ProgNote12<)*
5 Stock tank *(go to >i_ProgNote12<)*
6 Water-filled ditch *(go to >i_ProgNote12<)*

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7 Swimming pool *(go to **>i_ProgNote12<**)*
8 Bath tub *(go to **>i_ProgNote12<**)*
9 Hot tub or spa *(go to **>i_ProgNote12<**)*
10 Other
98 Unknown *(go to **>i_ProgNote12<**)*
99 Refusal *(go to **>i_ProgNote12<**)*

>inj_water_specify< "Please specify the type of body of water." _____

>i_ProgNote12< *[Programming Note: If((>inj_source1< = 9 and >Src_Cnt< = 1) or (>inj_source2< = 9 and >Src_Cnt< = 2)), go to **>inj_fall<**, else go to **>i_ProgNote13<**]*

>inj_fall< "When >Title< fell, did >he_she< fall on LEVEL GROUND OR FROM A DIFFERENT LEVEL?" *[Enumerator: If fall from one level to another, probe to classify into #1-6. Use 7 only if fall can't be classified into #1-6.]*

1 Fall on or from stairs or steps
2 Fall on or from ladders or scaffolding more than 20 ft.
3 Fall on or from ladders or scaffolding less than or equal to 20 ft.
4 Fall from or out of building or other structure
5 Fall into hole or other opening in surface
6 Fall on same level from slipping, tripping, or stumbling
7 Fall from one level to another
8 Slips & trips not resulting in a fall
98 Unknown
99 Refusal

>i_ProgNote13< *[Programming Note: If((>inj_source1< = 10 and >Src_Cnt< = 1) or (>inj_source2< = 10 and >Src_Cnt< = 2)), go to **>inj_sports<**, else go to **>i_ProgNote13a<**]*

>inj_sports< "What SPORT OR RECREATIONAL ACTIVITY >was_were< >Title< involved in when >he_she< got hurt?"

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11 Aerobics workout
12 Archery
13 Baseball
14 Basketball
15 Bicycling
16 Boating
17 Bowling
18 Broadjumping
19 Broomball
20 Cheerleading
21 Dancing
22 Field Hockey
23 Football
24 Golf
25 Gymnastics
26 Horseplay(adult)
27 Hunting
28 Ice fishing/Fishing
29 Ice hockey
30 Ice skating
31 Martial arts (judo, karate etc)
32 Physical education activities, general (non-specific)
33 Play activities, general childrens' (non-specific)
34 Playground activities
35 Racquetball
36 Rollerskating
37 Rollerblading
38 Running/jogging
39 Skateboarding
40 Skiing, crosscountry
41 Skiing/Snow-boarding, downhill
42 Sledding
43 Snowmobiling
44 Soccer
45 Softball
46 Swimming / Diving
47 Target practice/shooting (firearm, other than hunting
48 Tennis
49 Track and field
50 Volleyball
51 Water skiing
52 Weight lifting
53 3 - Wheeling / 4 - wheeling
54 Wrestling
55 Trampoline
56 Rodeo / Rodeo activities
57 Bystander
58 Horseback riding/racing
59 Kickball
60 Rugby
61 Riding/jumping Dirt bike / Motocross
10 Other, specify
98 Unknown
99 Refusal

>i_ProgNote13a< *[Programming Note: If(>inj_sports< not equal 10 and >inj_sports not equal 57), go to* ***>inj_sport_specify<*** *, else go to* ***>i_ProgNote13b<****]*

>inj_sport_specify< "Please specify the sport." _____

>i_ProgNote13b< *[Programming Note: If((>inj_source1< = 14 and >Src_Cnt< = 1) or (>inj_source2< = 14 and >Src_Cnt< = 2)), go to* ***>inj_selse<*** *, else go to* ***>i_ProgNote14<****]*

>inj_selse< "What physical object was involved when >Title< got hurt?"

1 Gate / Door *(go to* ***>i_ProgNote14<****)*
2 Wire / Barbed wire *(go to* ***>i_ProgNote14<****)*
3 Glass / Window *(go to* ***>i_ProgNote14<****)*
4 Nail *(go to* ***>i_ProgNote14<****)*
5 Stone / Rock / Bricks *(go to* ***>i_ProgNote14<****)*
6 Fence / Fence post *(go to* ***>i_ProgNote14<****)*
7 Pipe / Bar / Large piece of metal *(go to* ***>i_ProgNote14<****)*

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8 Ladder / Scaffolding *(go to **>i_ProgNote14<**)*
9 Foreign Object (Metal / wood / etc. – Splinter / chip / etc.) *(go to **>i_ProgNote14<**)*
10 Furniture / Cabinets / Large appliances *(go to **>i_ProgNote14<**)*
11 Rope / String / Twine / Reins / Bungee strap *(go to **>i_ProgNote14<**)*
12 Other.
98 Unknown *(go to **>i_ProgNote14<**)*
99 Refusal *(go to **>i_ProgNote14<**)*

>inj_selse_specify< "Please specify the physical object." _____

>i_ProgNote14< *[Programming Note:*
If ((>inj_source1< = 11 and >Src_Cnt< = 1) or
(>inj_source2< = 11 and >Src_Cnt< = 2))
>activity< = "HOUSEWORK" go to >inj_general<
Else if (>inj_source1< = 12 and >Src_Cnt< = 1) or
(>inj_source2< = 12 and >Src_Cnt< = 2)
>activity< = "YARDWORK"go to >inj_general<
Else if (>inj_source1< = 13 and >Src_Cnt< = 1) or (>inj_source2< = 13 and >Src_Cnt< = 2)
>activity< = "WORK UNRELATED TO FARM WORK"
go to >inj_general<
Else if (((>inj_source1< = 15 or >inj_source1< = 16 or >inj_source1< = 98 or >inj_source1< = 99) and >Src_Cnt< = 1) or (>inj_source2< = 15 and >Src_Cnt< = 2)
>activity< = "ACTIVITY" go to >inj_general<
*Else if (>Src_Cnt< = 1) **>Src_Cnt< = 2***
***go to >inj_source2<** Else*
***go to >inj_activity<** End if]*

>inj_general< "What type of >activity< >was_were< >Title< involved in when >he_she< got hurt?" *[Enumerator: **Type response exactly as stated + end with ///.** After entering information, press ESC to continue with interview.]*

_____

>inj_activity< "Tell me in your own words, what >was_were< >Title< DOING at the time of the injury?" *[Enumerator: **Type response exactly as stated + end with ///.** After entering information, press ESC to continue with interview.]*

_____

>injury_how< "In your own words, HOW did the accident happen?" *[Enumerator: **Type response exactly as stated + end with ///.** After entering information, press ESC to continue with interview.]* _____

>inj_date< "What was the DATE of the accident?" *[Enumerator: Ente as mm-dd-yyyy.]*

___/___/____ (mm/dd/yyyy) *(go to **>inj_time<**)*
99999998 Unknown
99999999 Resusal *(go to **>i_end1<**)*

>inj_month< "THEN, can you tell me the MONTH in which the accident happened?"

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1 January *(go to >inj_time<)*
2 February *(go to >inj_time<)*
3 March *(go to >inj_time<)*
4 April *(go to >inj_time<)*
5 May *(go to >inj_time<)*
6 June *(go to >inj_time<)*
7 July *(go to >inj_time<)*
8 August *(go to >inj_time<)*
9 September *(go to >inj_time<)*
10 October *(go to >inj_time<)*
11 November *(go to >inj_time<)*
12 December *(go to >inj_time<)*
98 Unknown
99 Refusal *(go to >i_end1<)*

>inj_season< "Could you tell me if this accident happened in the SPRING, SUMMER, FALL OR WINTER?"

1 Spring (Mar / Apr /May)
2 Summer (Jun / Jul /Aug)
3 Fall (Sept / Oct / Nov)
Winter (Dec / Jan / Feb)
Unknown
Refusal *(go to >i_end1<)*

>inj_time< "What TIME OF DAY did it happen?"

____:____ (hh:mm) military time *(go to >inj_part1<)*
99999998 Unknown
99999999 Resusal

>inj_time2< "THEN, could you tell me if this accident happened in the MORNING, AFTERNOON, EVENING OR NIGHT?"

1 Morning (6:00 am - 11:59 am)
2 Afternoon (12:00 pm - 5:59 pm)
3 Evening (6:00 pm - 11:59 pm)
4 Night (12:00 am - 5:59 am)
8 Unknown
9 Refusal

>inj_part1,< "What PARTS OF THE BODY were injured? If you have the DARK BLUE card with the figure, it will help you to answer this question."

101 Head / Skull
102 Brain
103 Face (Forehead, Cheek, Nose, Lip, Chin, Ear)
104 Eye / Eyelid
105 Dental / Tooth
106 Neck (Cervical area)
107 Spinal cord / Spine (Vertebrae, Sacrum, Tailbone / Coccyx, Discs)
108 Back (muscles/skin)
109 Internal chest (Ribs, Heart, Lung, Bronchial, Esophagus, Diaphragm)
110 External chest (Skin)
111 Internal abdomen (Stomach, Liver, Kidney, Gall bladder, Intestines, Appendix, Spleen, Pancreas)
112 External abdomen (Skin)
113 Shoulder / Collar bone / Shoulder blade
114 Arm / Elbow / Wrist / Carpal tunnel
115 Hand
116 Finger (s) / Thumb (s)
117 Internal hips / Pelvis (Uterus, Ovaries, Bladder, Rectum)
118 External hips / Pelvis (Skin)

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119 Buttocks
120 Genitals / "Private parts"
121 Leg (Thigh (s), Shin, Calf)
122 Knee
123 Ankle
124 Foot / Heel
125 Toes
126 General systems
127 No additional body parts
128 Other
129 Entire body
998 Unknown
999 Refusal

>i_ProgNote15< *[Programming Note: Loop through body parts listed from $_i$ = 1 to 6, at end go to **>inj_loc<**; otherwise*
*If (>inj_part1$_i$< = 127 or >inj_part1$_i$< = 998 or >inj_part1$_i$< = 999) go to **>inj_loc<***
*Else If (>inj_part1$_i$< = 128) go to **>inj_part1_specify<***
*Else go to **>desc_inj$_i$<***
End If]

>inj_part1$_i$_specify< "Specify the body part."
_____

>desc_inj$_i$< "Describe what types of injuries occured to the >inj_part1$_i$< Examples include: bruise or contusion, broken bone or fracture, amputation, or loss of consciousness."
*[Enumerator: **Type response exactly as stated + end with ///.** After entering information, press ESC to continue with interview.]*
_____ *(go to **>i_ProgNote15<**)*

>inj_serious< "How would you RATE THE SERIOUSNESS of this overall injury. Was it Minor, Moderate, Serious, Severe or Life-threatening?" *[Enumerator: If death occurred, enter 6.]*

1 Minor
2 Moderate
3 Serious
4 Severe
5 Life threatening
6 Death *(go to **>inj_care1<**)*
8 Unknown
9 Refusal

>inj_loc< "As a result of this accident, was there a LOSS OF CONSCIOUSNESS?"

1 Yes
3 No *(go to **>inj_amnesia<**)*
8 Unknown *(go to **>inj_amnesia<**)*
9 Refusal *(go to **>inj_amnesia<**)*

>inj_loc2< "Was this due to a BLOW TO THE HEAD, BEING OVERCOME BY FUMES OR SOMETHING ELSE?"

1 A blow to the head *(go to **>inj_loc3<**)*
2 Being overcome by fumes *(go to **>inj_loc3<**)*
3 Other

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8 Unknown *(go to **>inj_loc3<**)*
9 Refusal *(go to **>inj_loc3<**)*

>inj_loc2_specify< "Specify the reason for unconsciousness." *[Enumerator: **Type response exactly as stated + end with ///.** After entering information, press ESC to continue with interview.]* _____

>inj_loc3< "HOW LONG did it last?"

1 Less than 5 minutes
2 5 to less than 10 minutes
3 10 to less than 30 minutes
4 30 minutes to less than 1 hour
5 1 hour to less than 6 hours
6 6 hours to less than 24 hours
7 24 hours or more
8 Unknown
9 Refusal

>inj_amnesia< "Was there a LOSS OF AWARENESS, AMNESIA, OR CONFUSION?"

1 Yes
3 No *(go to **>inj_restrict<**)*
8 Unknown *(go to **>inj_restrict<**)*
9 Refusal *(go to **>inj_restrict<**)*

>inj_amnesia2< "Was this due to a BLOW TO THE HEAD, BEING OVERCOME BY FUMES OR SOMETHING ELSE?"

1 A blow to the head *(go to **>inj_amnesia3<**)*
2 Being overcome by fumes *(go to **>inj_amnesia3<**)*
3 Other
8 Unknown *(go to **>inj_amnesia3<**)*
9 Refusal *(go to**>inj_amnesia3<**)*

>inj_amnesia2_specify< "Specify the reason for amnesia." *[Enumerator: **Type response exactly as stated + end with ///.** After entering information, press ESC to continue with interview.]*

_____

>inj_amnesia3< "HOW LONG did it last?"

1 Less than 5 minutes
2 5 to less than 10 minutes
3 10 to less than 30 minutes
4 30 minutes to less than 1 hour
5 1 hour to less than 6 hours
6 6 hours to less than 24 hours
7 24 hours or more
8 Unknown
9 Refusal

>inj_restrict< "As a result of this accident, HOW LONG were normal activities restricted? Normal activities are the things a person would ordinarily do on any given day."

0 No restriction *(go to **>inj_care1<**)*
1 0 to less than 4 hours
2 4 hrs to less than 1 day
3 1 day to less than 7 days
4 7 days to less than 14 days
5 14 days to less than 1 month

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6 1 month to less than 3 months
7 3 months or more
8 Unknown *(go to >inj_care1<)*
9 Refusal *(go to >inj_care1<)*

>lost_farmwork< "Did >Title< lose ANY TIME from work around YOUR farming or ranching operation as a result of the accident?"

1 Yes
3 No *(go to >lostotherwork<)*
8 Unknown *(go to >lostotherwork<)*
9 Refusal *(go to >lostotherwork<)*

>lostfarmtime< "How MUCH TIME did >Title< lose from work?"

1 0 to less than 4 hours
2 4 hrs to less than 1 day
3 1 day to less than 7 days
4 7 days to less than 14 days
5 14 days to less than 1 month
6 1 month to less than 3 months
7 3 months or more
8 Unknown
9 Refusal

>lostotherwork< "Did >Title< lose ANY TIME from work at job(s) NOT RELATED to YOUR farming or ranching operation as a result of the accident?"

1 Yes
3 No *(go to >restrict_now<)*
8 Unknown *(go to >restrict_now<)*
9 Refusal *(go to >restrict_now<)*

>lostothertime< "How MUCH TIME did >Title< lose from these job(s)?"

1 0 to less than 4 hours
2 4 hrs to less than 1 day
3 1 day to less than 7 days
4 7 days to less than 14 days
5 14 days to less than 1 month
6 1 month to less than 3 months
7 3 months or more
8 Unknown
9 Refusal

>restrict_now< ">is_are< >Title< STILL RESTRICTED from carrying out >his_her< normal activities as a result of this injury?"

1 Yes
3 No *(go to >inj_symptoms<)*
8 Unknown *(go to >inj_symptoms<)*
9 Refusal *(go to >inj_symptoms<)*

>restrict_now2< "To what degree would you say >his_her< normal activities are CURRENTLY restricted? A small amount, a moderate amount or a large amount?"

1 A small amount
2 A moderate amount
3 A large amount
8 Unknown
9 Refusal

>inj_symptoms< "If you can turn to the two beige cards in the

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packet, it will help you identify some of these problems and symptoms.

At the present time, are there any PERSISTANT problems or symptoms related to this injury, including things such as numbness, pain, weakness, or some type of impairment?"

1 Yes
3 No *(go to >inj_care1<)*
8 Unknown *(go to >inj_care1<)*
9 Refusal *(go to >inj_care1<)*

>inj_symptoms2$_i$< "What part(s) of the body is/are affected? If you can turn to the dark blue card with the figure, it will help you answer this question."

101 Head / Skull
102 Brain
103 Face (Forehead, Cheek, Nose, Lip, Chin, Ear)
104 Eye / Eyelid
105 Dental / Tooth
106 Neck (Cervical area)
107 Spinal cord / Spine (Vertebrae, Sacrum, Tailbone / Coccyx, Discs)
108 Back (muscles/skin)
109 Internal chest (Ribs, Heart, Lung, Bronchial, Esophagus, Diaphragm)
110 External chest (Skin)
111 Internal abdomen (Stomach, Liver, Kidney, Gall bladder, Intestines, Appendix, Spleen, Pancreas)
112 External abdomen (Skin)
113 Shoulder / Collar bone / Shoulder blade
114 Arm / Elbow / Wrist / Carpal tunnel
115 Hand
116 Finger (s) / Thumb (s)
117 Internal hips / Pelvis (Uterus, Ovaries, Bladder, Rectum)
118 External hips / Pelvis (Skin)
119 Buttocks
120 Genitals / "Private parts"
121 Leg (Thigh (s), Shin, Calf)
122 Knee
123 Ankle
124 Foot / Heel
125 Toes
126 General systems
127 No additional body parts
128 Other
129 Entire body
998 Unknown
999 Refusal

>i_ProgNote16< *[Programming Note: Loop through body parts listed from $_i$ = 1 to*

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*6, at end go to **>inj_care1<**; otherwise*
*If (>inj_symptoms2$_i$< = 127 or >inj_symptoms2$_i$< = 998 or >inj_symptoms2$_i$< = 999) go to **>inj_care1<***
*Else If (>inj_symptoms2$_i$< = 128) go to **>inj_sympoms2_specify<***
*Else go to **>desc_sym$_i$<***
End If]

>inj_symptoms2_specify< "Specify the body part."

_____

>desc_sym$_i$< "What are the exact types of persistent problems or symptoms occurring to the >inj_symptoms2$_i$<.

Please refer to the two beige cards."

0 Persistent physical or mental impairment
1 Persistent numbness or tingling of injures area
2 Persistent pain only upon exertion or movement / intermittent pain
3 Persistent pain in injured area at all times
4 Headache that persists for more than a single day
5 General weakness
6 Weakness of arms or legs
7 Decreased range of motion
8 Paralysis
9 Loss of body part / amputation
10 Impaired vision, including blurred or double vision
11 Impaired speech
12 Impaired hearing
13 Reduced sense of balance or dizziness
14 Reduced ability to concentrate
15 Epilepsy / Convulsions
16 Reduced ability to do heavy work
17 Other, specify *[Enumerator: **Type response exactly as stated + end with ///.** After entering information, press ESC to continue with interview.]*
98 Unknown at this time if there will be permanent impairment
99 refusal

>inj_care1< "The following questions are about care of the injury. Was the injury treated by a health care professional, such as a doctor, nurse, chiropractor, dentist or other healthcare professional?"

1 Yes
3 No *(go to **>i_ProgNote18<**)*
8 Unknown *(go to **>i_ProgNote18<**)*
9 Refusal *(go to **>i_ProgNote18<**)*

>inj_care2$_i$< "In which of the following places did >Title< receive care?"

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1	A doctor's office	6	At the scene of the accident
2	A hospital emergency room	7	Any other health care facility
3	A hospital as an in-patient (admitted to a hospital)	8	Unknown
4	A dentist's office	9	Refusal
5	A chiropractor's office		

>i_ProgNote17< [Programming Note:
If (>inj_care2$_1$< not equal 3 and >inj_care2$_2$< not equal 3 and >inj_care2$_3$< not equal 3 and >inj_care2$_4$< not equal 3 and >inj_care2$_5$< not equal 3 and >inj_care2$_6$< nt equal 3 and >inj_care2$_7$< not equal 3) *go to* ***>inj_insurance<*** *End If]*

>inj_hospital< "How long >was_were< >Title< in the hospital?"

____ days
998 Unknown
999 Refusal

>inj_insurance< "What percentage of the costs of care for this injury was covered by health or medical insurance? Was it none, less than 50%, 50% to less than 100% or 100%(no deductable)?"

0	None	3	100% (No deductible)
1	Less than 50%	8	Unknown
2	50% to less than 100%	9	Refusal

>i_ProgNote18< *[Programming Note:*
If (>type_inj< = "On your own operation – injury #")

>inj_ownfarm< "For clarification, WAS THIS injury in any way related to YOUR farming or ranching operation activities? This includes activities such as transportation on roadways, or any other aspect of your operation, such as raising animals for recreation or home use. It could also include someone who was injured while standing or playing in AREAS WHERE FARMING OR RANCHING ACTIVITIES WERE TAKING PLACE."

1 Yes *(go to* ***>i_Prognote19<****)*
3 No
8 Unknown
9 Refusal

>inj_lsfarm< "Was it in any way related to motor vehicles, machinery, equipment, tools, livestock or working animals, storage structures, chemicals or bodies of water that are part of your farming or ranching operation?"

1 Yes *(go to* ***>i_Prognote19<****)*
3 No
8 Unknown
9 Refusal

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>inj_sefarm< "Was it in any way related to someone else's farming or ranching activities on YOUR operation?"

1 Yes *(go to **>i_Prognote19<**)*
3 No
8 Unknown
9 Refusal

>inj_whyfarm< "In what way was it related to YOUR farming or ranching operation?" *[Enumerator: **Type response exactly as stated + end with ///.** After entering information, press ESC to continue with interview.]* _____

>int_assess< "Was it in any way related to motor vehicles, machinery, equipment, tools, livestock or working animals, storage structures, chemicals or bodies of water that are part of your farming or ranching operation?"

1 Yes *(go to **>i_Prognote19<**)*
3 No
8 Unknown
9 Refusal

>i_ProgNote18< *[Programming Note: If (>age< ge 0 and >age< < 20 and (>inj_ownfarm< = 1 or >inj_lsfarm< = 1 or >inj_sefarm< = 1 or >int_assess< = 1)) >injmo< = 99 If ((>inj_date< ge {01/01/2001} and >inj_date< le {01/31/2001}) or >inj_month< = 1 or >inj_season< = 4) **>injmo<** = 1 Else if ((>inj_date< ge {02/01/2001} and >inj_date< le {02/28/2001}) or >inj_month< = 2) **injmo<** = 2 Else if ((>inj_date< ge {03/01/2001} and >inj_date< le {03/31/2001}) or >inj_month< = 3) **>injmo<** = 3 Else if ((>inj_date< ge {04/01/2001} and >inj_date< le {04/30/2001}) or >inj_month< = 4 or >inj_season< = 1**>injmo<** = 4 Else if ((>inj_date< ge {05/01/2001} and >inj_date< le {05/31/2001}) or >inj_month< = 5) **>injmo<** = 5 Else if ((>inj_date< ge {06/01/2001} and >inj_date< le {06/30/2001}) or >inj_month< = 6 or >inj_season< = 2) **>injmo<** = 6 Endif If (>injmo< = 99)Loop I = 1,6 If (>kidmo(>kidno<,i)< not equal 1) >kidmo(>kidno<,i) = 9 Continue Else >kidmo(>kidno<,i) = 1 End if End if] End If] Go to **>i_next_event<**] Loop j = 1, 6 If (>kidmo(>kidno<,j)< = 1) >no_f_inj(>kidno<)< = >no_f_inj(>kidno< + 1 Continue*
If (>no_f_inj(>kidno<)< > 0) >finj_kids< = >finj_kids< + 1
Go to >i_next_member<

Exposure Section

Control Selection Process

>e_ProgNote1< *[Programming Note: Carry over >persons19<, >kidmo(>persons19<,6)<, >no_f_inj(>persons19<)<, and >finj_kids<; Generate 3 random numbers, >random1<, >random2< and >random3<.*

Set: **>controlHH<** = 0; **>caseHH<** = 0

household control selection

If(>random1< is less than or equal to 0.188)
Household is selected as a control household

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>controlHH< = 1

Else

go to ***>e_next_caco<***

End If

subject control selection

If (>random2< greater than 0 and >random2< less than or equal to 1/>persons19<)

>exp< = 1

Else If(>random2< greater than 1/>persons19< and >random2< less than or equal to 2/>persons19<)

>exp< = 2

.....

Else If(>random2< greater than >persons19<-1/>persons19< and >random2< less than or equal to >persons19</>persons19<)

>exp< = >persons19<

End If

Set control subject to household member with >kidno< = >exp<

index month control selection

n = 125

If (>kidmo(>exp<,1)< not equal 0) n = n - 5

If (>kidmo(>exp<,2)< not equal 0) n = n - 6

If (>kidmo(>exp<,3)< not equal 0) n = n - 12

If (>kidmo(>exp<,4)< not equal 0) n = n - 17

If (>kidmo(>exp<,5)< not equal 0) n = n - 40

If (>kidmo(>exp<,6)< not equal 0) n = n - 45

>a< = 0

>b< = 0

If (>kidmo(>exp<,1)< = 0)

>b< = >b< + 2/n

If (>random3< greater then >a< and >random3< less than or equal to >b<)

>control_month< = 1

go to ***>e_next_caco<***

Else

>a< = >b<

End If

End If

If (>kidmo(>exp<,2)< = 0)

>b< = >b< + 1/n

If (>random3< greater then >a< and >random3< less than or equal to >b<)

>control_month< = 2

go to ***>e_next_caco<***

Else

>a< = >b<

End If

End If

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```
If (>kidmo(>exp<,3)< = 0)
    >b< = >b< + 4/n
    If (>random3< greater then >a< and >random3< less than
    or equal to >b<)
        >control_month< = 3
        go to >e_next_caco<
    Else
        >a< = >b<
    End If
End If
If (>kidmo(>exp<,4)< = 0)
    >b< = >b< + 6/n
    If (>random3< greater then >a< and >random3< less than
    or equal to >b<)
        >control_month< = 4
        go to >e_next_caco<
    Else
        >a< = >b<
    End If
End If
If (>kidmo(>exp<,5)< = 0)
    >b< = >b< + 12/n
    If (>random3< greater then >a< and >random3< less than
    or equal to >b<)
        >control_month< = 5
        go to >e_next_caco<
    Else
        >a< = >b<
    End If
End If
If (>kidmo(>exp<,6)< = 0)
    >b< = >b< + 15/n
    If (>random3< greater then >a< and >random3< less than
    or equal to >b<)
        >control_month< = 6
        go to >e_next_caco<
    Else
        >a< = >b<
    End If
End If
```


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>e_next_caco< *[Programming Note: The program loops through >imo< = 1-6, for >kidmo(>kidno<,>imo<)< = 1, for >kidno< = 1 to >persons19<, for >no_f_inj(>kidno<)< > 0 (set >**caseHH**< = 1); Then interviewing for control subject >kidno< = >exp<, >imo< = >control_month<; Then, go to **>exp_the_end**<. Identifiers carried forward for each member from the Household Log are >Title<, >first_name's<, >age<, >he_she<, >his_her<, >him_her<, >Who_Pi<, >was_were<, >is_are<.]*

>e_ProgNote2< *[Programming Note:*
If (>imo< = 1)
>month< = "January, 2001"
>month_before< = "December, 2000"
Else If (>imo< = 2)
>month< = "February, 2001"
>month_before< = "January, 2001"
Else If (>imo< = 3)
>month< = "March, 2001"
>month_before< = "February, 2001"
Else If (>imo< = 4)
>month< = "April, 2001"
>month_before< = "March, 2001"
Else If (>imo< = 5)
>month< = "May, 2001"
>month_before< = "April, 2001"
Else If (>imo< = 6)
>month< = "June, 2001"
>month_before< = "May, 2001"
End If

>introduction12< "In the next section of the interview, I will be asking questions about activities that >Title< was involved in for a ONE MONTH period of time, >month_before<, as well as questions about >his_her< health status, medication use and general habits.

The first questions will be about activities OTHER THAN FARMING OR RANCHING that >he_she< has been involved in, such as jobs, school and sporting activities."

1 *Continue*

>e_ProgNote3< *[Programming Note: If (>age< < 5) go to **>sports1**<]*

>nonfarmwk< "During >month_before<, did >Title< work in any type of paid job NOT related to farming or ranching?"

1 Yes 8 8 Unknown *(go to **>grade**<)*
3 No *(go to **>grade**<)* 9 Refusal *(go to **>grade**<)*

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>nonfarmwk_wks< "During that month, HOW MANY WEEKS did >he_she< work?"

__ 1-4 weeks
8 Unknown *(go to **>grade<**)*
9 Refusal *(go to **>grade<**)*

>nonfarmwk_hrs< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>grade< "During >month_before<, what was >first_name's< grade in school? (If >Title< didn't go to school that month, what grade had >he_she< last attended?)"

0 Kindergarten
____ 1–16 Years
17 Pre-school
97 N/A – None *(go to **>sports1<**)*
98 Unknown
99 Refusal

>school_wks< "During >month_before<, HOW MANY WEEKS did >he_she< spend in classes at school?"

0 None – Did not go to school *(go to **>sports1<**)*
__ 1-4 weeks
8 Unknown
9 Refusal

>school_hrs< "On average, how many HOURS PER WEEK?"

___ 1-40 hours
98 Unknown
99 Refusal

>school_rate< "How would you rate >his_her< school performance? Was it excellent, above average, average, below average or not satisfactory?"

1 Excellent *(go to **>sports1<**)*
2 Above average *(go to **>sports1<**)*
3 Average *(go to **>sports1<**)*
4 Below average *(go to **>sports1<**)*
5 Not satisfactory *(go to **>sports1<**)*
6 Other
8 Unknown *(go to **>sports1<**)*
9 Refusal *(go to **>sports1<**)*

>school_specify< "Please specify other."_____

>sports1< "During >month_before<, did >Title< participate in any sports or recreational activities?"

1 Yes 8
3 No *(go to **>introduction14<**)*
8 Unknown *(go to **>introduction14<**)*
9 Refusal *(go to **>introduction14<**)*

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>sports2$_1$< "In which sports or recreational activities did >he_she< particitpate?"

11	Aerobics workout	36	Rollerskating
12	Archery	37	Rollerblading
13	Baseball	38	Running/jogging
14	Basketball	39	Skateboarding
15	Bicycling	40	Skiing, crosscountry
16	Boating	41	Skiing/Snow-boarding, downhill
17	Bowling	42	Sledding
18	Broadjumping	43	Snowmobiling
19	Broomball	44	Soccer
20	Cheerleading	45	Softball
21	Dancing	46	Swimming / Diving
22	Field Hockey	47	Target practice/shooting (firearm, other than hunting
23	Football		
24	Golf	48	Tennis
25	Gymnastics	49	Track and field
26	Horseplay(adult)	50	Volleyball
27	Hunting	51	Water skiing
28	Ice fishing/Fishing	52	Weight lifting
29	Ice hockey	53	3 - Wheeling / 4 - wheeling
30	Ice skating	54	Wrestling
31	Martial arts (judo, karate etc)	55	Rodeo
		56	4H or FFA
32	Physical education activities, general (non-specific)	57	Horse riding/shows
		58	Music-Band, choir, etc.
		59	Scouting
33	Play activities, general childrens' (non-specific)	60	Motocross/Motorcycle/Dirt bike riding/racing
		10	Other
34	Playground activities	98	Unknown
35	Racquetball	99	Refusal

>e_ProgNote4< *[Programming Note: If (>sports2$_1$< not equal 10 and >sports2$_2$< not equal 10 and >sports2$_3$< not equal 10 and >sports2$_4$< not equal 10 and >sports2$_5$< not equal 10 and >sports2$_6$< not equal 10 and >sports2$_7$< not equal 10) go to* ***>sports_wks<****]*

>sports_specify< "Please specify other."

_____

>sports_wks< "During that month, HOW MANY WEEKS did >he_she< participate in these sports or recreational activities?"

__ 1-4 weeks
8 Unknown *(go to* ***>introduction14<****)*
9 Refusal *(go to* ***>introduction14<****)*

>sports_hrs< "On average, how many HOURS PER WEEK?"

___ 1-60 hours

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98 Unknown
99 Refusal

>introduction14< "In the following questions, I will be asking about >first_name's< prior health status, medication use and general health habits."

1 *Continue*

>prior_health< "Prior to >month<, did >he_she< have any of the following health or medical problems, that were diagnosed at ANY TIME by a physician, osteopath, chiropractor, or other health care provider?"

1 *Continue*

>pain< "Chronic or periodic pain in any part of their body?"

1 Yes
3 No
8 Unknown
9 Refusal

>movement< "Restriction of movement of any body part?"

1 Yes
3 No
8 Unknown
9 Refusal

>arthritis< "Arthritis?"

1 Yes
3 No
8 Unknown
9 Refusal

>liver< "Liver disease?"

1 Yes
3 No
8 Unknown
9 Refusal

>kidney< "Kidney disease?"

1 Yes
3 No
8 Unknown
9 Refusal

>heart< "Heart disease?"

1 Yes
3 No
8 Unknown
9 Refusal

>blood_pressure< "High blood pressure?"

1 Yes
3 No
8 Unknown
9 Refusal

>diabetes< "Diabetes?"

1 Yes
3 No
8 Unknown
9 Refusal

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>ADHD< "Hyperactivity or Attention Deficit Hyperactivity Disorder (ADHD)?"

1 Yes
3 No
8 Unknown
9 Refusal

>vision< "Vision problems not correctable with lenses?"

1 Yes
3 No
8 Unknown
9 Refusal

>stress< "Stress?"

1 Yes
3 No
8 Unknown
9 Refusal

>depress< "Depression or other psychological problems?"

1 Yes
3 No
8 Unknown
9 Refusal

>brain< "Brain or spinal cord injury or disease?"

1 Yes
3 No
8 Unknown
9 Refusal

>epilepsy< "Epilepsy?"

1 Yes
3 No
8 Unknown
9 Refusal

>asthma< "Asthma?"

1 Yes
3 No
8 Unknown
9 Refusal

>allergies< "Allergies?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote5< *[Programming Note: If (>pain< not equal 1, go to **>e_ProgNote6<**]*

>pain_int< "During >month_before<, did CHRONIC OR PERIODIC PAIN interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote6< *[Programming Note: If (>movement< not equal 1, go to **>e_ProgNote7<**]*

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>movement_int< "During >month_before<, did RESTRICTION OF MOVEMENT interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote7< *[Programming Note: If (>arthritis< not equal 1, go to **>e_ProgNote8<**]*

>arthritis_int< "During >month_before<, did ARTHRITIS interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote8< *[Programming Note: If (>liver< not equal 1, go to **>e_ProgNote9<**]*

>liver_int< "During >month_before<, did LIVER DISEASE interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote9< *[Programming Note: If (>kidney< not equal 1, go to **>e_ProgNote10<**]*

>kidney_int< "During >month_before<, did KIDNEY DISEASE interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote10< *[Programming Note: If (>heart< not equal 1, go to **>e_ProgNote11<**]*

>heart_int< "During >month_before<, did HEART DISEASE interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote11< *[Programming Note: If (>blood_pressure< not equal 1, go to **>e_ProgNote12<**]*

>blood_pressure_int< "During >month_before<, did HIGH BLOOD PRESSURE interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote12< *[Programming Note: If (>diabetes< not equal 1, go to **>e_ProgNote13<**]*

>diabetes_int< "During >month_before<, did DIABETES interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

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>e_ProgNote13< *[Programming Note: If (>ADHD< not equal 1, go to **>e_ProgNote14<**]*

>ADHD_int< "During >month_before<, did HYPERACTIVITY OR ADHD interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote14< *[Programming Note: If (>vision< not equal 1, go to **>e_ProgNote15<**]*

>vision_int< "During >month_before<, did VISION PROBLEMS NOT CORRECTABLE WITH LENSES interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote15< *[Programming Note: If (>stress< not equal 1, go to **>e_ProgNote16<**]*

>stress_int< "During >month_before<, did STRESS interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote16< *[Programming Note: If (>depress< not equal 1, go to **>e_ProgNote17<**]***>depress_int<** "During >month_before<, did DEPRESSION OR OTHER PSYCHOLOGICAL PROBLEMS interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote17< *[Programming Note: If (>brain< not equal 1, go to **>e_ProgNote18<**]*

>brain_int< "During >month_before<, did BRAIN OR SPINAL CORD INJURY OR DISEASE interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote18< *[Programming Note: If (>epilepsy< not equal 1, go to **>e_ProgNote19<**]*

>epilepsy_int< "During >month_before<, did EPILIPSY interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote19< *[Programming Note: If (>asthma< not equal 1, go to **>e_ProgNote20<**]*

>asthma_int< "During >month_before<, did ASTHMA interfere with any of >his_her< regular activities?"

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1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote20< *[Programming Note: If (>allergies< not equal 1, go to **>gen_health<**]*

>allergies_int< "During >month_before<, did ALLERGIES interfere with any of >his_her< regular activities?"

1 Yes
3 No
8 Unknown
9 Refusal

>gen_health< "During >month_before<, how would you rate >first_name's< general state of health: excellent, good, average, fair or poor?"

1 Excellent
2 Good
3 Average
4 Fair
5 Poor
8 Unknown
9 Refusal

>height_feet< "During that month, what was >his_her< approximate height?

In FEET"

__ 1-7
8 Unknown
9 Refusal

>height_inches< "and INCHES"

__ 0-11
98 Unknown
99 Refusal

>weight< "What was >his_her< approximate weight? (in pounds)"

____ 1-400
998 Unknown
999 Refusal

>hand< "Is >he_she< Right-handed, Left-handed or Ambidextrous?"

1 right handed
2 left handed
3 ambidextrous
8 Unknown
9 Refusal

>medication< "During >month_before<, did >Title< REGULARLY take ANY of the following medications? Regularly means DAILY for at LEAST ONE WEEK, or 3-4 TIMES per week during the month."

1 *Continue*

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>allergies_med< "Antihistamines, or allergy medications, such as Actifed, Allerest, Allegra, Claritin or Benadryl?"

1 Yes
3 No
8 Unknown
9 Refusal

>prepain_med< "Prescription pain medication such as Tylenol #3, codeine, phenylbutazone, Darvocet, Lortab or Ansaid?"

1 Yes
3 No
8 Unknown
9 Refusal

>otcpain_med< "Over the counter (OTC) pain relievers, such as aspirin, Advil, Aleve, Orudis or Tylenol?"

1 Yes
3 No
8 Unknown
9 Refusal

>ritalin_med< "Ritalin or other medicine for treatment of hyperactivity?"

1 Yes
3 No
8 Unknown
9 Refusal

>heart_med< "Heart medication?

1 Yes
3 No
8 Unknown
9 Refusal

>blood_med< "Blood Pressure medications?"

1 Yes
3 No
8 Unknown
9 Refusal

>depress_med< "Anti-depressants / Mood elevators?"

1 Yes
3 No
8 Unknown
9 Refusal

>diet_med< "Amphetamines, decongestants, or pep pills, including diet pills?"

1 Yes
3 No
8 Unknown
9 Refusal

>insulin_med< "Insulin?"

1 Yes
3 No
8 Unknown
9 Refusal

>tranq_med< "Tranquilizers, sedatives, sleeping medications, such as Valium or

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Diazepam?"

1 Yes
3 No
8 Unknown
9 Refusal

>antibiotics_med< "Antibiotics, such as penicillin, erythromycin, tetracycline or sulfa drugs?"

1 Yes
3 No
8 Unknown
9 Refusal

>diuretics_med< "Diuretics or water pills?"

1 Yes
3 No
8 Unknown
9 Refusal

>introduction14a< "The next questions are about >first_name's< sleep and exercise patterns during >month_before<."

1 *Continue*

>sleep1< "During that month, on average, how many hours of sleep did >he_she< get each night?"

__ 1-24 hours
98 Unknown
99 Refusal

>sleep2< "How often was it difficult for >him_her< to wake up on mornings >he_she< needed to be up for chores, work or school: never, sometimes, often or always?"

1 Never
2 Sometimes
3 Often
4 Always
8 Unknown
9 Refusal

>sleep3< "How often was it difficult for >him_her< to go to sleep at night, such as taking more than an hour to get to sleep: never, sometimes, often or always?"

1 Never
2 Sometimes
3 Often
4 Always
8 Unknown
9 Refusal

>exercise< "During >month_before<, did >Title< actively participate in any regular exercise at least 3 days a week, for twenty minutes or more, that made >him_her< sweat?"

1 Yes
3 No
8 Unknown
9 Refusal

>introduction15< "The next few questions ask about YOUR experience in strictness with >Title<. We recognize that parents differ in how strict they are with their children because of children's abilities at different ages.

Prior to >month<, how STRICT were you about the FOLLOWING: not strict, somewhat strict, moderately strict or very strict?"

1 *Continue*

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>strict1< "Knowing where >he_she< was?"

1	Not Strict	7	N/A
2	Somewhat Strict	8	Unknown
3	Moderately Strict	9	Refusal
4	Very Strict		

>strict2< "Knowing who >he_she< was with when >he_she< was out?"

1	Not Strict	7	N/A
2	Somewhat Strict	8	Unknown
3	Moderately Strict	9	Refusal
4	Very Strict		

>strict3< "Making certain that >he_she< used a seatbelt or car seat when riding or driving in a car or other motor vehicle?"

1	Not Strict	7	N/A
2	Somewhat Strict	8	Unknown
3	Moderately Strict	9	Refusal
4	Very Strict		

>strict4< "Making certain that >he_she< used farm equipment safely?"

1	Not Strict	7	N/A
2	Somewhat Strict	8	Unknown
3	Moderately Strict	9	Refusal
4	Very Strict		

>strict5< "Making certain that >he_she< worked safely around animals?"

1	Not Strict	7	N/A
2	Somewhat Strict	8	Unknown
3	Moderately Strict	9	Refusal
4	Very Strict		

>e_ProgNote21< *[Programming Note: If (>age< < 5) go to* ***>introduction16b<****]*

>introduction16< "The next questions are about your perception of >first_name's< behaviors or actions during >month_before<. Choose the answer that best describes HOW OFTEN the following happened or WAS TRUE of >him_her< during that month. Would you say that >he_she< ALMOST NEVER, SOMETIMES, OFTEN or ALMOST ALWAYS..."

1 *Continue*

>complete< "Completed >his_her< work and chores?"

1	Almost never	4	Almost always
2	Sometimes	8	Unknown
3	Often	9	Refusal

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>followrules< "Followed rules?"

1 Almost never
2 Sometimes
3 Often
4 Almost always
8 Unknown
9 Refusal

>thinking< "Acted without thinking?"

1 Almost never
2 Sometimes
3 Often
4 Almost always
8 Unknown
9 Refusal

>fights< "Got into fights?"

1 Almost never
2 Sometimes
3 Often
4 Almost always
8 Unknown
9 Refusal

>hard< "Worked hard?"

1 Almost never
2 Sometimes
3 Often
4 Almost always
8 Unknown
9 Refusal

>impulse< "Was impulsive?"

1 Almost never
2 Sometimes
3 Often
4 Almost always
8 Unknown
9 Refusal

>broke< "Broke rules?"

1 Almost never
2 Sometimes
3 Often
4 Almost always
8 Unknown
9 Refusal

>careful< "Liked to plan carefully before going ahead?"

1 Almost never
2 Sometimes
3 Often
4 Almost always
8 Unknown
9 Refusal

>still< "Couldn't sit still?"

1 Almost never
2 Sometimes
3 Often
4 Almost always
8 Unknown
9 Refusal

>distract< "Was easily distracted?"

1 Almost never
2 Sometimes

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3	Often	8	Unknown
4	Almost always	9	Refusal

>cautious< "Was cautious?"

1	Almost never	4	Almost always
2	Sometimes	8	Unknown
3	Often	9	Refusal

>irritable< "Was irritable?"

1	Almost never	4	Almost always
2	Sometimes	8	Unknown
3	Often	9	Refusal

>runaway< "Left the house or farm without permission?"

1	Almost never	4	Almost always
2	Sometimes	8	Unknown
3	Often	9	Refusal

>attention< "Paid attention?"

1	Almost never	4	Almost always
2	Sometimes	8	Unknown
3	Often	9	Refusal

>sad< "Looked sad or down?"

1	Almost never	4	Almost always
2	Sometimes	8	Unknown
3	Often	9	Refusal

>bully< "Bullied or was mean to others?"

1	Almost never	4	Almost always
2	Sometimes	8	Unknown
3	Often	9	Refusal

>energy< "Had low energy?"

1	Almost never	4	Almost always
2	Sometimes	8	Unknown
3	Often	9	Refusal

>conc< "Had good concentration?"

1	Almost never	4	Almost always
2	Sometimes	8	Unknown
3	Often	9	Refusal

>introduction16b< "The next questions are about stress >Title<, you and the rest of your family experienced during the three months PRIOR TO >month<: NOT STRESSFUL, SOMEWHAT STRESSFUL, MODERATELY

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STRESSFUL or VERY STRESSFUL."

1 *Continue*

>stress1< "During that period, how stressful did you feel life was for >Title<?"

1	Not stressful	4	Very stressful
2	Somewhat stressful	8	Unknown
3	Moderately stressful	9	Refusal

>stress2< "How stressful did you feel life was for you?"

1	Not stressful	4	Very stressful
2	Somewhat stressful	8	Unknown
3	Moderately stressful	9	Refusal

>stress3< "How stressful did you feel life was for your family?"

1	Not stressful	4	Very stressful
2	Somewhat stressful	8	Unknown
3	Moderately stressful	9	Refusal

>introduction17< "The next questions are about children and their abilities as they mature. When you are deciding whether a child is READY to do a new chore on the farm or ranch, HOW IMPORTANT are each of the following in making that decision? NOT IMPORTANT, SOMEWHAT IMPORTANT, MODERATELY IMPORTANT or VERY IMPORTANT?"

1 *Continue*

>ready1< "How important is the child's age?"

1	Not important	4	Very important
2	Somewhat important	8	Unknown
3	Moderately important	9	Refusal

>ready2< "The size of the child?"

1	Not important	4	Very important
2	Somewhat important	8	Unknown
3	Moderately important	9	Refusal

>ready3< "Whether the child is a boy or a girl?"

1	Not important	8	Unknown
2	Somewhat important	9	Refusal
3	Moderately important		
4	Very important		

>ready4< "The maturity of the child, or how responsible the child is?"

1	Not important
2	Somewhat important
3	Moderately important
4	Very important

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8 Unknown
9 Refusal

>ready5< "How important are the skills of the child?"

1 Not important
2 Somewhat important
3 Moderately important
4 Very important
8 Unknown
9 Refusal

>ready6< "The danger level of the task, or new chore?"

1 Not important
2 Somewhat important
3 Moderately important
4 Very important
8 Unknown
9 Refusal

>ready7< "Prior formal training of the child, such as 4-H or Vo-Ag training?"

1 Not important
2 Somewhat important
3 Moderately important
4 Very important
8 Unknown
9 Refusal

>ready8< "Other training of the child, by people involved in YOUR operation?"

1 Not important
2 Somewhat important
3 Moderately important
4 Very important
8 Unknown
9 Refusal

>ready_othr< "Are there any other characteristics about a child that you consider important in deciding if they are ready for a new chore?"

1 Yes
3 No *(go to **>safety1<**)*
8 Unknown *(go to **>safety1<**)*
9 Refusal *(go to **>safety1<**)*

>ready_specify< "Please specify." _____

>safety1< "In your opinion, at what age would an average young person be ready to work with animals (including beef cattle, dairy cattle and swine)--- feeding, cleaning, etc.?"

__ 0-19 years
98 Unknown
99 Refusal

>safety2< "At what age would a child be ready to ride on or in a tractor?"

__ 0-19 years
98 Unknown
99 Refusal

>safety3< "At what age would a child be ready to drive or operate a tractor?"

__ 0-19 years
98 Unknown
99 Refusal

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>introduction18< "Next I would like to ask about chores or farmwork >Title< may have performed on YOUR farming or ranching operation, during >month_before<."

1 *Continue*

>chores_many< "During that month, would you say that >he_she< did as many chores or farmwork as were expected by the family, more chores or less chores than were expected?"

0 N/A – None were expected *(go to **>introduction19<**)*
1 Did less than expected
2 Did about what was expected
3 Did more than expected
8 Unknown
9 Refusal

>chores_well< "How well would you say that >he_she< performed the chores or farmwork that were expected by the family? Better than expected, about what was expected or worse than expected?"

1 Did worse than expected
2 Did about what was expected
3 Did better than expected
8 Unknown
9 Refusal

>introduction19< "The next few questions are about YOUR farming or ranching operation."

1 *Continue*

>farming1< "Prior to >month<, how many years had you been farming or ranching?"

0 < 0 year
__ 1-90 years
98 Unknown
99 Refusal

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>acres< "During >month_before<, of the acres that you own, plus the acres that you rent or lease, how many did you have in use or active production, including land in hay and pasture? Do not include wasteland, woodlands, or land in long term CRP (Conservation Reserve Programs) or any set aside programs."

_____	0-99,997
99998	Unknown
99999	Refusal

>enterpr< "During >month_before<, of the following farm enterprises, which ONE required the MOST amount of WORK TIME on your farm or ranch?" *[Enumerator: Read list of possible answers.]*

1 Beef cattle *(go to **>roadways<**)*
2 Dairy cattle *(go to **>roadways<**)*
3 Other animals (i.e. poultry, sheep, swine, horses, etc.) *(go to **>roadways<**)*
4 Field, forage or specialty crops *(go to **>roadways<**)*
5 CRP (Conservation Reserve Program) or Set-aside program *(go to **>roadways<**)*
6 Other
8 Unknown *(go to **>roadways<**)*
9 Refusal *(go to **>roadways<**)*

>enterpr_specify< "Specify other." _____

>roadways< "During that month, did anyone involved in your operation travel on public roadways with farm equipment? Public roadways refers to township, county and state roads. Field roads or private roads should not be considered public roadways."

1 Yes 8 Unknown
3 No 9 Refusal

>milking1< "During >month_before<, did you have any type of milking system in use?"

1 Yes 8 Unknown *(go to **>firearms1<**)*
3 No *(go to **>firearms1<**)* Refusal *(go to **>firearms1<**)*

>milking2< "What type?

1 Automatic Pipeline Washing System (Clean in Place – CIP) *(go to **>firearms1<**)*
2 Bucket/Manual System (Open) *(go to **>firearms1<**)*
3 Other
8 Unknown *(go to **>firearms1<**)*
9 Refusal *(go to **>firearms1<**)*

>milking_specify< "Please specify." _____

>firearms1< "During >month_before<, were there any firearms present on your operation?"

1 Yes 3 No *(go to **>income<**)*

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8 Unknown *(go to* ***>income<****)* 9 Refusal *(go to* ***>income<****)*

>firearms2< "How many were shotguns?"

__ 0-97
98 Unknown
99 Refusal

firearms3< "How many were rifles?"

__ 0-97
98 Unknown
99 Refusal

>firearms4< "How many were handguns?"

__ 0-97
98 Unknown
99 Refusal

>enterpr< "Please estimate your 2000 net household income, after taxes, from all sources. Would it be:" *[Enumerator: Read list of possible answers.]*

1 Less than $15,000
2 $15,000 - $29,999
3 $30,000 - $49,999
4 $50,000 - $99,999
5 $100,000 - $174,999
6 $175,000 - $249,999
7 $250,000 or more
8 Unknown
9 Refusal

>prevent1< "Do you believe that some farming or ranching operation-related injuries can be prevented?"

1 Yes 8 Unknown *(go to* ***>intro<****)*
3 No *(go to* ***>prevent3<****)* Refusal *(go to* ***>intro<****)*

>prevent2< "What are the two main things you think can be done to prevent injuries that occur on the farm or ranch?" *[Enumerator:* ***Type response exactly as stated + end with ///****. After entering information, press ESC to continue with interview.]*

_____

(go to ***>intro<****)*

>prevent3< "Why is it that you feel they can't be prevented?" *[Enumerator:* ***Type response exactly as stated + end with ///****. After entering information, press ESC to continue with interview.]*

_____

(go to ***>intro<****)*

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Exposure Section – Part II

Respondent Selection Process

>intro< "In the next series of questions, I will be asking questions about selected people who HAD AN INJURY BETWEEN JANUARY 1st, 2001 and JUNE 30, 2001 as well as selected people who DID NOT HAVE AN INJURY during that period. This will provide important information on factors that may either cause an injury or protect people from injury and can be used to develop effective prevention programs."

>e_ProgNote22< *[Programming Note: Set* ***>Exp_Resp<*** *= >Cur_Resp<]*
If (>Age< ≥ 12 years old)
go to ***>child_permission<***
Else If (>Exp_Resp< = 2)
go to ***>Introduction>***
Else
go to ***>best_respondent1<***
End If]

>child_permission< "May I speak with >Title< to ask some questions about >his_her< activities on the farm or ranch? The interview should take approximately 20 minutes."

1 Yes *(go to* ***>inf_consent4a<****)*
3 No
5 Parent agrees, but child is not available *(go to* ***>callback<****)*

>e_ProgNote23< *[Programming Note: If (>Exp_Resp< not equal 2) go to* ***>best_respondent2<****)*

>cont_resp< "In that case, we would like to ask you the remaining questions. You can have someone else assist with the answers, if you wish."

1 *go to* ***>Introduction<***

>best_respondent1< "We would like to speak with the adult in your household who knows the most about >first_name's< farming or ranching related activities and how many hours >he_she< spent on these activities during >month_before<. Would that be you or the male head of household?"

1 Current respondent – Female head of household *(go to* ***> Introduction<****)*
3 Male head of household *(go to* ***>get_other<****)*
5 Someone Else *(go to* ***>want_HH<****)*
9 Refusal *(go to* ***>exp_end2<****)*

>best_respondent2< "In that case, we would like to speak with the adult in your household who knows the most about >first_name's< farming or ranching related activities and how many hours >he_she< spent on these

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activities during >month_before<. Would that be you or the male head of household?"

1 Current respondent – Female head of household (*go to* > ***Introduction<)***
3 Male head of household (*go to* ***>get_other<)***
5 Someone Else (*go to* ***>want_HH<)***

>want_HH< "We prefer to ask these questions only of the female head of household or the male head of household, but you can certainly have someone else assist with the answers. Can you continue with these questions, or should I speak with the male head of household?"

1 Continue with current respondent – Female head of household (*go to* > ***Introduction<)***
3 Male head of household (*go to* ***>get_other<)***
9 Refusal (*go to* ***>exp_end2<)***

>get_other< "Is he available now to answer questions?" ("May I speak with him?")

1 Yes, he comes to the phone *(go to* ***>inf_consent5a<)***
3 No, he's not willing to answer (*go to* ***>cont_resp<)***
5 No, he's not available

>willing< "Since he's not available to answer these questions now, would you be willing to try to answer these questions for us? You can have someone else assist with the answers, if you wish."

1 Yes (*go to* > ***Introduction<)***
3 No (*go to* ***>callback<)***
9 Refusal (*go to* ***>exp_end2<)***

>inf_consent4a< "Hello, this is >EnumName< calling for the >StateName< Agricultural Statistics Service. We are conducting a project with the University of Minnesota on farming and ranching operations. >Who_Pi< agreed to have your household participate in this project and has been answering questions about who resides in your household, some characteristics of your operation and any injuries that may have occurred."

1 *Continue*

>inf_consent4b< "We would like to ask you some questions about your activities on your farming or ranching operation. You do not have to answer these questions but your cooperation is important for us to get accurate information. If you are uncomfortable with any question, you may choose not to answer that one, and we will move on to the next question. All the information we collect is confidential. Would you be willing to help us by answering some questions about your activities on the farm or ranch?"

1 Yes *[Set: >Exp_Resp2< = 3;(go to* ***>Introduction<)]***
3 No [If (>Age< ≥ 18) *go to* ***>reasonc<]***

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>HHLog_back< "Would you be able to put >Who_Pi< back on the phone so I may speak with him/her?"

1 Yes, prior respondent comes back
3 No *(go to **>callback<**)*

>HHLog_again< ">Title< has requested not to be interviewed."

1 *go to **>best_respondent2<***

>reasonc< "May I ask why you prefer not to continue at this time?"

1 Doesn't have time now *(go to **>callback<**)*
2 Isn't comfortable with the questions *(go to **>reconsider5c<**)*
3 Can't see the value of the interview *(go to **>reconsider6c<**)*
4 No clear reason, just refuses *(go to **>reconsider7c<**)*

>reconsider5c< "If you are uncomfortable with any question, we can skip that one and go on to another. Would you be willing to continue if we skip the questions you prefer not to answer?"

1 Yes *[Set: >Exp_Resp< = 3;(go to **>Introduction<**)]*
3 No *(go to **>exp_end2<**)*

>reconsider6c< "The results of this project will be used to develop effective injury prevention programs that will benefit all farming and ranching households. It is important that we interview all eligible housholds, whether or not there were any injuries. This will provide important information about factors that may prevent injuries. May we continue?"

1 Yes *[Set: >Exp_Resp2< = 3;(go to **>Introduction<**)]*
3 No *(go to **>exp_end2<**)*

>reconsider7c< "The results of this project will be used to develop effective injury prevention programs that will benefit all farming and ranching households. It is important that we interview all eligible housholds, whether or not there were any injuries. This will provide important information about factors that may prevent injuries.If you are uncomfortable with any question, we can skip that one and go on to another. Or we can call back at a time that is more convenient. May we continue, or would you prefer that we call back?"

1 Yes, continue *[Set: >Exp_Resp2< = 3;(go to **>Introduction<**)]*
3 No, refuses to continue *(go to **>exp_end2<**)*
5 Schedule a callback *(go to **>callback<**)*

>inf_consent5a< "Hello, this is >EnumName< calling for the >StateName< Agricultural Statistics Service. We are conducting a project with the University of Minnesota on farming and ranching operations.

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>Who_Pi< agreed to have your household participate in this project and has been answering questions about who resides in yur household, some characteristics of your operation and any injuries that may have occurred."

1 *Continue*

>inf_consent5b< "We would like to ask some questions about >first_name's< activities on your farming or ranching operation. You do not have to answer these questions but your cooperation is important for us to get accurate information. If you are uncomfortable with any question, you may choose not to answer that one, and we will move on to the next question. All the information we collect is confidential. Would you be willing to help us by answering some questions about >first_name's< activities on the farm or ranch?"

1 Yes *[Set: >Exp_Resp2< = 2;(go to **>Introduction<**)]*
3 No

>HHLog_back2< "Would you be able to put >Who_Pi< back on the phone so I may speak with him/her?"

1 Yes, prior respondent comes back
3 No *(go to **>callback<**)*

>HHLog_again2< ">Title< has requested not to be interviewed."

1 *go to **>cont_resp<***

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Exposure Section – Part II

Interview

>introduction< "In this section we would like to ask some questions about chores or work >Title< did. These questions relate specifically to FARMWORK, and by farmwork I mean any activities connected with your farming or ranching operation, either on or off the farm/ranch, including driving to town to get supplies. This will also include information about working with animals, driving vehicles, operating farm machinery and other tasks. Some of the questions will be general, while others will ask about a certain month of the year."

1 *Continue*

>farmwork< "During >month_before<, did >Title< work in any type of activities or do chores related to YOUR operation?"

1 Yes 8 Unknown *(go to **>othrfarm<**)*
3 No *(go to **>othrfarm<**)* Refusal *(go to **>othrfarm<**)*

>wks_farmwork< "During that month, HOW MANY WEEKS did >he_she< work on these activities?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs_farmwork< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>othrfarm< "During >month_before<, did >Title< work in any type of activities or do chores related to SOMEONE ELSE'S farming or ranching operation?"

1 Yes 8 Unknown *(go to **>e_ProgNote24<**)*
3 No *(go to **>e_ProgNote24<**)* Refusal *(go to **>e_ProgNote24<**)*

>wks_othrfarm< "During that month, HOW MANY WEEKS did >he_she< work on these activities?"

__ 1-4 weeks
8 Unknown
9 Refusal

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>hrs_othrfarm< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>e_ProgNote24< *[Programming Note: If (>farmwork< not equal 1) go to **>bystanding1<**]*

>introduction2< "The following questions are about work or chores >Title< did with animals on YOUR farming or ranching operation during >month_before<."

1 *Continue*

>animals< "During that month, did >he_she< work or do chores with ANY TYPE of animals?"

1 Yes 8 Unknown *(go to **>bystanding1<**)*
3 No *(go to **>bystanding1<**)* 9 Refusal *(go to **>bystanding1<**)*

>dairy< "Did >he_she< work or do chores with any type of dairy cattle? (Do not include dairy steers.)"

1 Yes 8 Unknown *(go to **>beef<**)*
3 No *(go to **>beef<**)* 9 Refusal *(go to **>beef<**)*

>dairy1< "Which of the following types of dairy cattle did >he_she< work with:

A dairy cow with it's newborn calf or calves?"

1 Yes 8 Unknown
3 No 9 Refusal

>dairy2< "A dairy calf away from it's mother?"

1 Yes 8 Unknown
3 No 9 Refusal

>dairy3< "Dairy bulls?"

1 Yes 8 Unknown
3 No 9 Refusal

>dairy4< "Dairy cows or heifers?"

1 Yes 8 Unknown
3 No 9 Refusal

>act1_dairy< "The next questions are about >his_her< activities when working with dairy cattle on YOUR operation. During >month_before<, which of the following did >he_she< do:

Feed the dairy cattle?"

1 Yes 8 Unknown *(go to **>act2_dairy<**)*
3 No *(go to **>act2_dairy<**)*

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9 Refusal *(go to >act2_dairy<)*

>wks1_dairy< "For HOW MANY WEEKS?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs1_dairy< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>act2_dairy< "Did >he_she< milk the cows?"

1 Yes
3 No *(go to >act3_dairy<)*
8 Unknown *(go to >act3_dairy<)*
9 Refusal *(go to >act3_dairy<)*

>wks2_dairy< "For HOW MANY WEEKS?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs2_dairy< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>act3_dairy< "Did >he_she< clean inside the barn, including the stalls?"

1 Yes
3 No *(go to >act4_dairy<)*
8 Unknown *(go to >act4_dairy<)*
9 Refusal *(go to >act4_dairy<)*

>wks3_dairy< "For HOW MANY WEEKS?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs3_dairy< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>act4_dairy$_i$< "Which of the following OTHER activities did >he_she< do with dairy cattle?" *[Enumerator: Read list of possible answers]*

0 None
1 Calving
2 Footwork
3 Herding, moving, loading, or unloading cattle
4 Giving medical treatments, including injections
5 Dehorning
6 Branding

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7 Butchering
8 Castration
9 Other

98 Unknown
99 Refusal

>e_ProgNote25< *[Programming Note:*
If (>act4_dairy$_1$< = 0)
go to ***>beef<***
Else If (>act4_dairy$_1$< = 9 or >act4_dairy$_2$< = 9 or >act4_dairy$_3$< = 9 or >act4_dairy$_4$< = 9 or >act4_dairy$_5$< = 9 or >act4_dairy$_6$< = 9 or >act4_dairy$_7$< = 9 or >act4_dairy$_8$< = 9 or >act4_dairy$_9$< = 9)
go to ***>act_dairy_specify<***
Else
go to ***>wks4_dairy<***
End If]

>act_dairy_specify< "Specify other activity."

_____

>wks4_dairy< "During that month, HOW MANY WEEKS did >he_she< do any of these OTHER activities, with the dairy cattle?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs4_dairy< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>beef< "During >month_before<, did >Title< work or do chores with any type of beef cattle, including dairy steers, on YOUR operation?"

1 Yes
3 No *(go to* ***>swine<****)*
8 Unknown *(go to* ***>swine<****)*
9 Refusal *(go to* ***>swine<****)*

>beef1< "Which of the following types of beef cattle did >he_she< work with:

A beef cow with it's newborn calf or calves?"

1 Yes
3 No
8 Unknown
9 Refusal

>beef2< "A beef calf away from it's mother?"

1 Yes
3 No
8 Unknown
9 Refusal

>beef3< "Beef bulls?"

1 Yes
3 No
8 Unknown
9 Refusal

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>beef4< "Beef cows or heifers?"

1	Yes	8	Unknown
3	No	9	Refusal

>beef5< "Steers, including both dairy and beef steers?"

1	Yes	8	Unknown
3	No	9	Refusal

>act1_beef< "The next questions are about >his_her< activities when working with beef cattle on YOUR operation. During >month_before<:

Did >he_she< feed the beef cattle?"

1	Yes	8	Unknown
3	No	9	Refusal

>act3_beef$_i$< "Which of the following OTHER activities did >he_she< do with the beef cattle?" *[Enumerator: Read list of possible answers]*

0	None	6	Branding
1	Calving	7	Butchering
2	Footwork	8	Castration
3	Herding, moving, loading, or unloading cattle	9	Other
4	Giving medical treatments, including injections	98	Unknown
		99	Refusal
5	Dehorning		

>e_ProgNote26< *[Programming Note:*
If (>act3_beef$_1$< = 9 or >act3_beef$_2$< = 9 or >act3_beef$_3$< = 9 or >act3_beef$_4$< = 9 or >act3_beef$_5$< = 9 or >act3_beef$_6$< = 9 or >act3_beef$_7$< = 9 or >act3_beef$_8$< = 9 or >act3_beef$_9$< = 9)
go to ***>act_beef_specify<***
Else
go to ***>wks_beef<***
End If]

>act_beef_specify< "Specify other activity."

_____

>wks_beef< "During that month, HOW MANY WEEKS did >he_she< do any activities with the beef cattle?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs_beef< "On average, how many HOURS PER WEEK?"

____ 1-130 hours

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998 Unknown
999 Refusal

>swine< "During >month_before<, did >Title< work or do chores with any type of swine or pigs, on YOUR operation?"

1 Yes
3 No *(go to **>othranimal<**)*
8 Unknown *(go to **>othranimal<**)*
9 Refusal *(go to **>othranimal<**)*

>swine_1< "Which of the following types of swine did >he_she< work with:

Sows with piglets?"

1 Yes
3 No
8 Unknown
9 Refusal

>swine_2< "Sows without piglets / gilt?"

1 Yes
3 No
8 Unknown
9 Refusal

>swine_3< "Feeder pigs?"

1 Yes
3 No
8 Unknown
9 Refusal

>swine_4< "Boars?"

1 Yes
3 No
8 Unknown
9 Refusal

>act1_swine< "The next questions are about >his_her< activities when working with swine on YOUR operation. During >month_before<, did >he_she<:

Feed the swine?"

1 Yes
3 No
8 Unknown
9 Refusal

>act2_swine< "Clean the pens or crates?"

1 Yes
3 No
8 Unknown
9 Refusal

>act3_swine< "Move, load or unload the swine?"

1 Yes
3 No
8 Unknown
9 Refusal

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>act4_swine$_1$< "Which of the following OTHER activities did >he_she< do with the swine:" *[Enumerator: Read list of possible answers]*

0 None
1 Giving medical treatments, including injections
2 Butchering
3 Castration
4 Other
8 Unknown
9 Refusal

>e_ProgNote27< *[Programming Note:*
If (>act4_swine$_1$< = 4 or >act4_swine$_2$< = 4 or >act4_swine$_3$< = 4 or >act4_swine$_4$< = 4)
go to ***>act_swine_specify<***
Else
go to ***>wks_swine<***
End If]

>act_swine_specify< "Specify other activity."

_____

>wks_swine< "During that month, HOW MANY WEEKS did >he_she< do any activities with the swine?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs_swine< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>othranimal< "During >month_before<, did >Title< work or do chores with any other type of livestock or animals, including horses, sheep, or poultry, on YOUR operation?"

1 Yes
3 No *(go to* ***>riskanimal<****)*
8 Unknown *(go to* ***>riskanimal<****)*
9 Refusal *(go to* ***>riskanimal<****)*

>horse< "Did >he_she< work with any horses?"

1 Yes
3 No *(go to* ***>sheep<****)*
8 Unknown *(go to* ***>sheep<****)*
9 Refusal *(go to* ***>sheep<****)*

>horse_1< "Did >he_she< work with stallions or stud horses?"

1 Yes
3 No
8 Unknown
9 Refusal

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>othrhorse< "Did >he_she< work with any other types of horses?"

1 Yes
3 No
8 Unknown
9 Refusal

>wks_horse< "During that month, HOW MANY WEEKS did >he_she< work with the horses?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs_horse< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>sheep< "During >month_before<, did >he_she< work with any sheep on YOUR operation?"

1 Yes
3 No *(go to **>poultry<**)*
8 Unknown *(go to **>poultry<**)*
9 Refusal *(go to **>poultry<**)*

>wks_sheep< "During that month, HOW MANY WEEKS did >he_she< work with the sheep?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs_horse< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>poultry< "Did >he_she< work with any poultry?"

1 Yes
3 No *(go to **>riskanimal<**)*
8 Unknown *(go to **>riskanimal<**)*
9 Refusal *(go to **>riskanimal<**)*

>wks_poultry< "During that month, HOW MANY WEEKS did >he_she< work with the poultry?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs_poultry< "On average, how many HOURS PER

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WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>riskanimal< "PRIOR to >month<, how much risk of injury did you believe there was for >Title< when working with animals on YOUR operation? No risk, some risk, moderate risk, or a lot of risk"

1 No risk
2 Some risk
3 Moderate risk
4 A lot of risk
8 Unknown
9 Refusal

>bystanding1< "During >month_before<, how often >was_were< >he_she< watching activities, playing or standing around, but not working, in buildings or areas where animals were kept? Never, sometimes, or frequently?"

1 Never
2 Sometimes
3 Frequently
8 Unknown
9 Refusal

>e_ProgNote28< *[Programming Note:*
If (>farmwork< not equal 1)
go to ***>bystanding5<***
Else If (>Age< < 5)
go to ***>introduction3b<***
End If]

>introduction3a< "In the following questions I will be asking if, during >month_before<, >Title< operated or rode, IN OR ON, any motor vehicles, FOR ACTIVITIES DIRECTLY RELATED TO YOUR FARMING OR RANCHING OPERATION."

1 *Continue*

>motorveh1< "During that month, did >he_she< operate a car, van, sport utility vehicle, pickup truck, grain truck or other truck?"

1 Yes
3 No *(go to* ***>vehride1<****)*
8 Unknown *(go to* ***>vehride1<****)*
9 Refusal *(go to* ***>vehride1<****)*

>wks_motorveh1< "For HOW MANY WEEKS did >he_she< operate any of these vehicles?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs_motorveh1< "On average, how many HOURS PER WEEK?"

____ 1-130 hours *(go to* ***>vehride1<****)*
998 Unknown *(go to* ***>vehride1<****)*

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999 Refusal *(go to **>vehride1<**)*

>introduction3b< "In the following questions I will be asking if, during >month_before<, >Title< rode, IN OR ON, any motor vehicles, FOR ACTIVITIES DIRECTLY RELATED TO YOUR FARMING OR RANCHING OPERATION."

1 *Continue*

>vehride1< "Did >he_she< ride as a passenger in a car, van, sport utility vehicle, pickup truck, grain truck or other truck?"

1 Yes
3 No *(go to **>e_ProgNote29<**)*
8 Unknown *(go to **>e_ProgNote29<**)*
9 Refusal *(go to **>e_ProgNote29<**)*

>wks_vehride1< "For HOW MANY WEEKS did >he_she< ride in any of these vehicles?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs_vehride1< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>e_ProgNote29< *[Programming Note:*
If (>motorveh1< not equal 1 and >vehride1< not equal 1)
*go to **>motorveh2<***
Else If (>Age< ≥ 5)
*go to **>seatbelt2<***
End If]

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>seatbelt1< "When they rode in one of these vehicles, how often did they wear a seatbelt or use a car safety seat? Never, seldom, sometimes, nearly always or always?"

1 Never *(go to* ***>motorveh2<****)*
2 Seldom *(go to* ***> >motorveh2<****)*
3 Sometimes *(go to* ***>motorveh1<****)*
4 Nearly always *(go to* ***>motorveh2<****)*
5 Always *(go to* ***>motorveh2<****)*
8 Unknown *(go to* ***> >motorveh2<****)*
9 Refusal *(go to* ***> >motorveh2<****)*

>seatbelt2< "When >he_she< operated or rode in one of these vehicles, how often did >he_she< wear a seatbelt? Never, seldom, sometimes, nearly always or always?"

1 Never
2 Seldom
3 Sometimes
4 Nearly always
5 Always
8 Unknown
9 Refusal

>motorveh2< "During >month_before<, did >he_she< operate or ride on a motorcycle, all terrain vehicle (ATV or ATC) or snowmobile?"

1 Yes
3 No *(go to* ***>bystanding5<****)*
8 Unknown *(go to* ***>bystanding5<****)*
9 Refusal *(go to* ***>bystanding5<****)*

>wks_motorveh2 "During that month, HOW MANY WEEKS did >he_she< operate or ride on any of these vehicles?"

__ 1-4 weeks
8 Unknown
9 Refusal

>hrs_motorveh2< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>helmet< "When they operated or rode in ANY of these vehicles, how often did they wear a helmet? Never, seldom, sometimes, nearly, always or always?"

1 Never
2 Seldom
3 Sometimes
4 Nearly always
5 Always
8 Unknown
9 Refusal

>bystanding5< "During >month_before<, how often >was_were< >he_she< watching activities, playing or standing around, but not working, in the driveway. Never, sometimes or frequently?"

1 Never
2 Sometimes
3 Frequently
8 Unknown

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9 Refusal

>e_ProgNote30< *[Programming Note:*
If (>farmwork< not equal 1 or >Age< <5) go to ***>introduction5<]***

>introduction4< "Now I will ask about work or chores >Title< did with large farm machinery, on YOUR farming or ranching operation, during >month_before<. By large machinery I mean tractors, tillage equipment, and other farm implements."

1 *Continue*

>tractor1< "During that month, did >he_she< operate any tractors greater than 20 horsepower, on your farming or ranching operation?"

1	Yes	8	Unknown
3	No	9	Refusal

>tractor2< "Did >he_she< operate any tractors 20 horsepower or less, on your farming or ranching operation? This does not include skid steer tractors?"

1	Yes	8	Unknown
3	No	9	Refusal

>e_ProgNote31< *[Programming Note: If (>tractor1< not equal 1 and >tractor2< not equal 1) go to* ***>tractor3<]***

>tractor1_many< "How many of either of these tractors did >he_she< operate?"

__ 1-10 hours
98 Unknown
99 Refusal

>tractor1_wks "During that month, HOW MANY WEEKS did >he_she< operate EITHER of these types of tractors?"

__ 1-4 weeks
8 Unknown
9 Refusal

>tractor1_hrs< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>tractor1_PTO< "Did ANY of the tractors have a Power-Take-Off?"

1	Yes	8	Unknown *(go to* ***>tractor1_ROPS<)***
3	No *(go to* ***>tractor1_ROPS<)***	9	Refusal *(go to* ***>tractor1_ROPS<)***

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>tractor1_shield< "Did ALL of THESE have a PTO shield in place when >he_she< used it?"

1 Yes
3 No
8 Unknown
9 Refusal

>tractor1_PTOdrive< "Did ANY of the tractors use a PTO to drive another piece of equipment?"

1 Yes
3 No
8 Unknown
9 Refusal

>tractor1_conn< Did >he_she< connect an implement to ANY of the PTOs?"

1 Yes
3 No
8 Unknown
9 Refusal

>tractor1_ROPS< "Did ALL of the tractors have an approved Roll Over Protective Structure? This could include a 2 or 4 post frame or a cab with a built-in ROP structure."

1 Yes
3 No
8 Unknown
9 Refusal

>tractor3< "During >month_before<, did >he_she< operate ANY skid steer tractors, such as a Bobcat?"

1 Yes
3 No *(go to **>e_ProgNote32<**)*
8 Unknown *(go to **>e_ProgNote32<**)*
9 Refusal *(go to **>e_ProgNote32<**)*

>tractor3_wks "During that month, HOW MANY WEEKS did >he_she< operate this type of tractor?"

__ 1-4 weeks
8 Unknown
9 Refusal

>tractor3_hrs< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>e_ProgNote32< *[Programming Note: If (>tractor1< not equal 1 and >tractor2< not equal 1 and >tractor3< not equal 1) go to **>introduction5<**]*

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>tractor_age< "At what age did >Title< begin to drive or operate any type of tractor on your operation?"

__ 1-19
98 Unknown
99 Refusal

>introduction5< "In the following questions, I will ask about time >Title< spent RIDING ON a tractor, as a passenger or as a helper, on YOUR farming or ranching operation, during >month_before<."

1 *Continue*

>ride_tractor< "During that month, did >he_she< ride on/in ANY type of tractor as a passenger or helper?"

1 Yes
3 No *(go to **>e_ProgNote35<**)*
8 Unknown *(go to **>e_ProgNote35<**)*
9 Refusal *(go to **>e_ProgNote35<**)*

>ridetractor1< "Did >he_she< ride on/in any tractor greater than 20 horsepower?"

1 Yes
3 No
8 Unknown
9 Refusal

>ridetractor2< "During >month_before<, did >Title< ride on/in any tractor 20 Horsepower or less?"

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote33< *[Programming Note: If (>ridetractor1< not equal 1 and >ridetractor2< not equal 1) go to **>ridetractor3<**]*

>ridetractor1_wks "During that month, HOW MANY WEEKS did >he_she< ride on EITHER of these types of tractors?"

__ 1-4 weeks
8 Unknown
9 Refusal

>ridetractor1_hrs< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>ride1_cab< "Did ALL of the tractors have an approved Roll Over Protective Structure? This could include a 2 or 4 post frame or a cab with a built-in ROP structure."

1 Yes
3 No
8 Unknown
9 Refusal

>ride1_impl1< "Was an implement connected to any of the

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tractors?"

1 Yes
3 No *(go to **>ridetractor3<**)*
8 Unknown *(go to **>ridetractor3<**)*
9 Refusal *(go to **>ridetractor3<**)*

>ride1_impl2< "Did >he_she< ride on any of the implements connected to the tractors?"

1 Yes
3 No
8 Unknown
9 Refusal

>ridetractor3< "During >month_before<, did >Title< ride on any skid steer tractor, such as a Bobcat?"

1 Yes
3 No *(go to **>e_ProgNote34<**)*
8 Unknown *(go to **>e_ProgNote34<**)*
9 Refusal *(go to **>e_ProgNote34<**)*

>ridetractor3_wks "During that month, HOW MANY WEEKS did >he_she< ride on/in this type of tractor?"

__ 1-4 weeks
8 Unknown
9 Refusal

>ridetractor3_hrs< "On average, how many HOURS PER WEEK?"

____ 1-130 hours
998 Unknown
999 Refusal

>e_ProgNote34< *[Programming Note: If (>ridetractor1< not equal 1 and >ridetractor2< not equal 1 and >ridetractor3< not equal 1) go to **e_ProgNote34a<**]*

>tractor_age2< "At what age did >Title< begin to ride on/in ANY type of tractor on YOUR operation?"

__ 1-19
98 Unknown
99 Refusal

>e_ProgNote34a< *[Programming Note: If (>tractor1< not equal 1 and >tractor2< not equal 1 and >tractor3< not equal 1 and >ridetractor1< not equal 1 and >ridetractor2< not equal 1 and >ridetractor3< not equal 1) go to **e_ProgNote35<**]*

>tractor_risk< "PRIOR to >month<, how much risk of injury did you believe there was for >Title< when RIDING ON OR WORKING WITH tractors on YOUR operation? No risk, some risk, moderate risk, or a lot of risk"

1 No risk
2 Some risk
3 Moderate risk
4 A lot of risk

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8 Unknown 9 Refusal

>e_ProgNote35< *[Programming Note:*

If (>Age< < 5)
*go to **>bystanding3<***
Else if (If (>tractor1< not equal 1 and >tractor2< not equal 1 and >tractor3< not equal 1)
*go to **>e_ProgNote35a<***
End if]

>training1< "PRIOR to >month<, did >month< ever take a 4-H or Vo-Ag training program to learn to operate a tractor?"

1 Yes
3 No *(go to **>e_ProgNote35a<**)*
8 Unknown *(go to **>e_ProgNote35a<**)*
9 Refusal *(go to **>e_ProgNote35a<**)*

>training2a< "PRIOR to >month<, when did the most recent training take place?

What year?"

____ 1980-2001
9998 Unknown
9999 Refusal

>training2b< "What month?"

__ 1-12
98 Unknown
99 Refusal

>training3< "How many hours of training did this involve?"

____ 1-130 hours
998 Unknown
999 Refusal

>e_ProgNote35a< *[Programming Note: If (>farmwork< not equal 1 or >age< < 5) go to **>bystanding3<**]*

>introduction6< "Next I will ask about LARGE EQUIPMENT that >Title< may have worked with on YOUR farming or ranching operation, during >month_before<.

1 *Continue*

>largemach< "During that month, did >he_she< operate or help to operate ANY large pieces of machinery or equipment, such as any tillage, planting or harvesting equipment, augers, elevators, feed grinders, mixers or wagons?"

1 Yes
3 No *(go to **>largemach2<**)*
8 Unknown *(go to **>largemach2<**)*
9 Refusal *(go to **>largemach 2<**)*

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>tillage_scr< "Did >he_she< operate or help to operate any tillage equipment, such as discs, field cultivators or plows?"

1 Yes
3 No *(go to **>planting_scr<**)*
8 Unknown *(go to **>planting_scr<**)*
9 Refusal *(go to **>planting_scr<**)*

>tillage0< "Did >he_she< operate or help to operate any powered tillers?"

1 Yes
3 No *(go to **>tillage<**)*
8 Unknown *(go to **>tillage<**)*
9 Refusal *(go to **>tillage<**)*

>tillage_PTO< "Did ANY of the powered tillers have a Power-Take-Off?"

1 Yes
3 No *(go to **>tillage<**)*
8 Unknown *(go to **>tillage<**)*
9 Refusal *(go to **>tillage<**)*

>tillage_shield< "Were ALL of the PTOs on the powered tillers shielded?"

1 Yes
3 No
8 Unknown
9 Refusal

>tillage$_i$< "Which of the following other types of tillage equipment did >he_she< operate or help to operate?" *[Enumerator: Read list of possible answers]*

0 None – No other tillage equipment
1 Disc
2 Moldboard plow
3 Field cultivator
4 Chisel plow
5 Rotary hoe
6 Row crop cultivator
7 Cultipacker
8 Other
98 Unknown
99 Refusal

>e_ProgNote36< *[Programming Note:*
If (>tillage$_1$< = 8 or >tillage$_2$< = 8 or >tillage$_3$< = 8 or >tillage$_4$< = 8 or >tillage$_5$< = 8 or >tillage$_6$< = 8 or >tillage$_7$< = 8 or >tillage$_8$< = 8)
*go to **>tillage_specify<***
Else
*go to **>planting_scr<***
End If]

>tillage_specify< "Specify other."

_____

>planting_scr< "During >month_before<, did >Title< operate or help to operate any planting equipment, such as planters or drills?"

1 Yes
3 No *(go to **>harvesting_scr<**)*
8 Unknown *(go to **>harvesting_scr<**)*

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9 Refusal *(go to* ***>harvesting_scr<****)*

>planting$_i$< "Which of the following types of planting equipment did >he_she< operate or help to operate?" *[Enumerator: Read list of possible answers]*

0	None – No other tillage equipment	3	Other
1	Planters	8	Unknown
2	Drills	9	Refusal

>e_ProgNote37< *[Programming Note:*
If (>planting$_1$< = 3 or >planting$_2$< = 3 or >planting$_3$< = 3)
go to ***>planting_specify<***
Else
go to ***>planting_PTO<***
End If]

>planting_specify< "Specify other."

_____

>planting_PTO< "Did ANY of the planting equipment have a Power-Take-Off?"

1	Yes	8	Unknown *(go to* ***>harvesting_scr<****)*
3	No *(go to* ***>harvesting_scr<****)*	9	Refusal *(go to****>harvesting_scr<<****)*

>planting_shield< "Were ALL of the PTOs on the planting equipment shielded?"

1	Yes	8	Unknown
3	No	9	Refusal

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>harvesting_scr< "During that month, did >he_she< operate or help to operate any harvesting equipment, such as combines or pickers?"

1 Yes
3 No *(go to **>augers_scr<**)*
8 Unknown *(go to **>augers_scr<**)*
9 Refusal *(go to **>augers_scr<**)*

>harvesting< "Did >he_she< operate or help to operate any self-propelled combines?"

1 Yes
3 No *(go to **>harvesting2_scr<**)*
8 Unknown *(go to **>harvesting2_scr<**)*
9 Refusal *(go to **>harvesting2_scr<**)*

>combine_shield< "Were ALL of the moving parts of the combines shielded?"

1 Yes
3 No
8 Unknown
9 Refusal

>harvesting2_scr< "Did >he_she< operate or help to operate any other harvesting equipment connected to a tractor, such as a forage harvester, mower, baler, stacker, pull-type combine, corn picker or specialty harvester?"

1 Yes
3 No *(go to **>augers_scr<**)*
8 Unknown *(go to **>augers_scr<**)*
9 Refusal *(go to **>augers_scr<**)*

>pickers$_i$< "Which of the following types of harvesting equipment did >he_she< operate or help to operate?" *[Enumerator: Read list of possible answers]*

0 None – No other harvesting equipment
1 Disc
2 Moldboard plow
3 Field cultivator
4 Chisel plow
5 Rotary hoe
6 Row crop cultivator
7 Cultipacker
8 Other
98 Unknown
99 Refusal

>e_ProgNote38< *[Programming Note:*
If (>pickers$_1$< = 8 or >pickers$_2$< = 8 or >pickers$_3$< = 8 or >pickers$_4$< = 8 or >pickers$_5$< = 8 or >pickers$_6$< = 8 or >pickers$_7$< = 8 or >pickers$_8$< = 8)
*go to **>pickers_specify<***
Else
*go to **>pickers_PTO<***
End If]

>pickers_specify< "Specify other."

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>pickers_PTO< "Did ANY of these types of harvesting equipment have a Power-Take-Off?"

1 Yes
3 No *(go to **>augers_scr<**)*
8 Unknown *(go to **>augers_scr<**)*
9 Refusal *(go to**>augers_scr<<**)*

>pickers_shield< "Were ALL of the PTOs on the harvesting equipment shielded?"

1 Yes
3 No
8 Unknown
9 Refusal

>augers_scr< "During >month_before<, did >Title< operate or help to operate any augers or elevators?"

1 Yes
3 No *(go to **>feedgrinder_scr<**)*
8 Unknown *(go to **>feedgrinder_scr<**)*
9 Refusal *(go to **>feedgrinder_scr<**)*

>augers1< "Which of the following did >he_she< operate or help to operate:

Portable or fixed augers?"

1 Yes
3 No
8 Unknown
9 Refusal

>augers2< "Elevators or conveyors?"

1 Yes
3 No
8 Unknown
9 Refusal

>augers_PTO< "Did ANY of the augers or elevators have a Power-Take-Off?"

1 Yes
3 No *(go to **>feedgrinder_scr<**)*
8 Unknown *(go to **>feedgrinder_scr<**)*
9 Refusal *(go to**>feedgrinder_scr<<**)*

>augers_shield< "Were ALL of the PTOs on the implements shielded?"

1 Yes
3 No
8 Unknown
9 Refusal

>feedgrinder_scr< "During that month, did >he_she< operate or help to operate any feed grinders or mixers?"

1 Yes
3 No *(go to **>wagons_scr<**)*
8 Unknown *(go to **>wagons_scr<**)*
9 Refusal *(go to **>wagons_scr<**)*

>feedgrinder1< "Which of the following did >he_she< operate or help to operate:

Feed grinders?"

1 Yes
3 No
8 Unknown
9 Refusal

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>feedgrinder2< "Mixers?"

1 Yes
3 No
8 Unknown
9 Refusal

>feedgrinder_PTO< "Did ANY of the feed grinders or mixers have a Power-Take-Off?"

1 Yes
3 No *(go to **>wagons_scr<**)*
8 Unknown *(go to **>wagons_scr<**)*
9 Refusal *(go to**>wagons_scr<<**)*

>grinder_shield< "Were ALL of the PTOs on the feed grinders or mixers shielded?"

1 Yes
3 No
8 Unknown
9 Refusal

>wagons_scr< "During>month_before<, did >Title< work on or with any wagons, such as hay racks, forage wagons, gravity boxes or grain carts?"

1 Yes
3 No *(go to **>largemach2<**)*
8 Unknown *(go to **>largemach2<**)*
9 Refusal *(go to **>largemach2<**)*

>wagons$_i$< "Which of the following types of wagons did >he_she< work on or with?" *[Enumerator: Read list of possible answers]*

1 Hay rack
2 Forage wagon
3 Gravity box
4 Grain cart
5 Other
8 Unknown
9 Refusal

>e_ProgNote39< *[Programming Note:*
If (>wagons$_1$< = 5 or >wagons$_2$< = 5 or >wagons$_3$< = 5 or >wagons$_4$< = 5 or >wagons$_5$< = 5)
*go to **>wagons_specify<***
Else
*go to **>wagons_PTO<***
End If]

>wagons_specify< "Specify other."

>wagons_PTO< "Did ANY of the wagons have a Power-Take-Off?"

1 Yes
3 No *(go to **>wagons_scr<**)*
8 Unknown *(go to **>wagons_scr<**)*
9 Refusal *(go to**>wagons_scr<<**)*

>wagons_shield< "Were all of the PTOs on the wagons shielded? "

1 Yes
3 No
8 Unknown
9 Refusal

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>largemach2< "During >month_before<, did >Title< operate or help to operate ANY equipment for irrigation, chemical or fertilizer application, manure application, or other external or self-powered farm or ranch equipment?"

1 Yes
3 No *(go to **>e_ProgNote40<**)*
8 Unknown *(go to **>e_ProgNote40<**)*
9 Refusal *(go to **>e_ProgNote40<**)*

>irrigation< "Which of the following did >he_she< operate or help to operate:

Irrigation equipment?"

1 Yes
3 No
8 Unknown
9 Refusal

>manure< "Manure application equipment?"

1 Yes
3 No
8 Unknown
9 Refusal

>externalpower< "Other equipment powered by an external source, such as silage or forage blowers, or grain dryers?"

1 Yes
3 No
8 Unknown
9 Refusal

>selfpower< "Other self-powered equipment, such as back-hoes, caterpillars, forklifts, or earth moving equipment?"

1 Yes
3 No
8 Unknown
9 Refusal

>largemach2_PTO< "Did ANY of the these types of equipment have a Power-Take-Off?"

1 Yes
3 No *(go to **>e_ProgNote40<**)*
8 Unknown *(go to **>e_ProgNote40<**)*
9 Refusal *(go to**>e_ProgNote40<<**)*

>largemach2_shield< "Were ALL of the PTOs on this equipment shielded? "

1 Yes
3 No
8 Unknown
9 Refusal

>e_ProgNote40< *[Programming Note: If (>largemach< not equal 1 and >largemach2< not equal 1) go to **>bystanding3<**]*

>riskequip< "PRIOR to >month<, how much risk of injury did you believe there was for >Title< when working with large equipment on YOUR operation? No risk, some risk, moderate risk, or a lot of risk"

1 No risk
2 Some risk
3 Moderate risk
4 A lot of risk
8 Unknown
9 Refusal

>bystanding3< "During >month_before<, how often was/were >he_she< watching activities,

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playing or standing around, but not working, in fields where machinery was being used? Never, sometimes or frequently?"

1 Never
2 Sometimes
3 Frequently
8 Unknown
9 Refusal

>bystanding4< "During that month, how often >was_were< >he_she< watching activities, playing or standing around, but not working, in fields where machinery was stored? Never, sometimes or frequently?"

1 Never
2 Sometimes
3 Frequently
8 Unknown
9 Refusal

>e_ProgNote41< *[Programming Note: If (>farmwork< not equal 1 or >Age< < 5) go to* ***>bystanding2<****]*

>introduction7< "Next I will ask about small power equipment and hand tools >Title< may haved worked with on YOUR farming or ranching operation, during >month_before<."

1 *Continue*

>smallequip< "During that month, did >he_she< operate or handle any grinders, powered shop tools, chain saws, garden tillers or hand tools, to perform activities on YOUR operation?"

1 Yes
3 No *(go to* ***>bystanding2<****)*
8 Unknown *(go to* ***>bystanding2<****)*
9 Refusal *(go to* ***>bystanding2<****)*

>smallequip1< "Which of the following did >he_she< operate or handle:

Portable grinders?"

1 Yes
3 No
8 Unknown
9 Refusal

>smallequip2< "Stationary grinders?"

1 Yes
3 No
8 Unknown
9 Refusal

>smallequip3< "Stationary powered shop tools, such as a table saw or drill press?"

1 Yes
3 No
8 Unknown
9 Refusal

>smallequip4< "Portable powered shop tools, such as a portable saw or drill?"

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1 Yes
3 No
8 Unknown
9 Refusal

>smallequip5< "Chain saw?"

1 Yes
3 No
8 Unknown
9 Refusal

>smallequip6< "Other small powered equipment such as a garden tiller, lawn mower or snow blower?"

1 Yes
3 No
8 Unknown
9 Refusal

>smallequip7< "Hand tools, such as hammers, chisels or saws?"

1 Yes
3 No
8 Unknown
9 Refusal

>bystanding2< "During >month_before<, how often >was_were< >he_she< watching activities, playing or standing around, but not working, in a farm or ranch shop? Never, sometimes or frequently?"

1 Never
2 Sometimes
3 Frequently
8 Unknown
9 Refusal

>e_ProgNote42< *[Programming Note: If (>farmwork< not equal 1) go to **>bystanding6<**]*

>introduction8< "Next I will ask questions about work >Title< may have done inside ANY type of storage structure, on YOUR farming or ranching operation, during >month_before<."

1 *Continue*

>storage< "During that month, did >he_she< work inside any storage structure, such as a grain bin, silo, fruit storage bin or manure pit?"

1 Yes
3 No *(go to **>introduction9<**)*
8 Unknown *(go to **>introduction9<**)*
9 Refusal *(go to **>introduction9<**)*

>storage1< "Whcih of the following did >he_she< work inside:

A grain bin or grainary?"

1 Yes
3 No
8 Unknown
9 Refusal

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>storage2< "A silo?"

1 Yes
3 No
8 Unknown
9 Refusal

>storage3< "A fruit or other non-grain storage structure?"

1 Yes
3 No
8 Unknown
9 Refusal

>storage4< "A manure pit?"

1 Yes
3 No
8 Unknown
9 Refusal

>introduction9< "Next I will ask questions about work or chores >Title< may have done with chemicals, or activities near water and on ladders, on YOUR farming or ranching operation, during >month_before<."

1 *Continue*

>chemical< "During that month, did >he_she< mix, handle or apply any type of agricultural chemicals, including anhydrous ammonia, pesticides, fuels, lubricants, cleaning agents, veterinary medicines or other chemicals?"

1 Yes
3 No *(go to* ***>water<****)*
8 Unknown *(go to* ***>water<****)*
9 Refusal *(go to* ***>water<****)*

>chemical1< "Did >he_she< handle anhydrous ammonia?"

1 Yes
3 No
8 Unknown
9 Refusal

>chemical2< "Did >he_she< mix, handle or apply pesticides, including: Insectides, herbicides, fungicides and fumigants?"

1 Yes
3 No *(go to* ***>chemical3<****)*
8 Unknown *(go to* ***>chemical3<****)*
9 Refusal *(go to* ***>chemical3<****)*

>pesticides< "Were ALL the pesticides stored in containers labeled with the word DANGER or WARNING?"

1 Yes
3 No
8 Unknown
9 Refusal

>chemical3$_i$< "Which of the following other types of chemicals did >he_she< mix, handle or apply?" *[Enumerator: Read list of possible answers]*

1 Fuels, lubricants or cleaning agents
2 Veterinary Medicines
3 Other chemical products, such as household products, paint, solvents, etc.

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4 Other
8 Unknown
9 Refusal

>e_ProgNote43< *[Programming Note:*
If (>chemical3$_1$< = 4 or >chemical3$_2$< = 4 or >chemical3$_3$< = 4 or >chemical3$_4$< = 4)
go to ***>chemical_specify<***
Else
go to ***>water<***
End If]

>chemical_specify< "Specify other." _____

>water< "During >month_before<, did >he_she< work in or near a body of water, such as a lake, river, swamp or pond on YOUR operation? This also includes stock tanks and water filled ditches."

1 Yes
3 No *(go to* ***>bystanding6<****)*
8 Unknown *(go to* ***>bystanding6<****)*
9 Refusal *(go to* ***>bystanding6<****)*

>water_yes$_i$< "Which of the follwing bodies of water did >he_she< work in or near?"
[Enumerator: Read list of possible answers]

1 Lake
2 River, stream, creek
3 Swamp
4 Pond (incl. Stock pond)
5 Stock tank
6 Water-filled ditch
7 Other
8 Unknown
9 Refusal

>e_ProgNote44< *[Programming Note:*
If (>water_yes$_1$< = 7 or >water_yes$_2$< = 7 or >water_yes$_3$< = 7 or >water_yes$_4$< = 7 or >water_yes$_5$< = 7 or >water_yes$_6$< = 7 or >water_yes$_7$< = 7)
go to ***>water_specify<***
Else
go to ***>bystanding6<***
End If]

>water_specify< "Specify other." _____

>bystanding6< "During >month_before<, how often >was_were< >he_she< watching activities, playing or standing around, but not working, near bodies of water? Never, sometimes or frequently?"

1 Never
2 Sometimes
3 Frequently
8 Unknown
9 Refusal

>e_ProgNote45< *[Programming Note: If (>farmwork< not equal 1) go to* ***>bystanding7<****]*

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>ladder< "During that month, did >he_she< work on ANY ladders or scaffolding, on YOUR operation?"

1 Yes
3 No *(go to **>general<**)*
8 Unknown *(go to **>general<**)*
9 Refusal *(go to **>general<**)*

>ladder1< "Which of the following did >he_she< work on:

Ladders or scaffolding greater than 20 feet tall?"

1 Yes
3 No
8 Unknown
9 Refusal

>ladder2< "Ladders or scaffolding 20 feet tall or less?"

1 Yes
3 No
8 Unknown
9 Refusal

>general< "During >month_before<, did >he_she< perform general farming or ranching related activities that we haven't discussed, such as repairing fences or other items?"

1 Yes
3 No *(go to **>bystanding7<**)*
8 Unknown *(go to **>bystanding7<**)*
9 Refusal *(go to **>bystanding7<**)*

>general_yes< "What types of activities did >he_she< do?" *[Enumerator: **Type response exactly as stated + end with ///.** After entering information, press ESC to continue with interview.]*

_____

>bystanding7< "During >month_before<, how often ><was_were< >he_she< watching activities, playing or standing around, but not working, out in the fields or barnyard? Never, sometimes or frequently?"

1 Never
2 Sometimes
3 Frequently
8 Unknown
9 Refusal

>riskplay< "PRIOR to >month<, how much risk of injury did you believe there was for >Title<, while watching activities, playing or standing around the farm yard, on YOUR operation? No risk, some risk, moderate risk, or a lot of risk"

1 No risk
2 Some risk
3 Moderate risk
4 A lot of risk
8 Unknown
9 Refusal

>e_ProgNote46< *[Programming Note: If (>Age< < 5) go to **>e_next_caco<**]*

>training4< "PRIOR to >month<, how many hours had >he_she< spent in training or seminars concerned with farm safety and injury prevention?"

0 None *(go to **>e_ProgNote47<**)*
____ 1-130 hours

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998 Unknown *(go to **>e_ProgNote47<**)*
999 Refusal *(go to **>e_ProgNote47<**)*

>training5a< "PRIOR to >month<, when did the most recent course or seminar take place?

What year?"

____ 1980-2001
9998 Unknown
9999 Refusal

>training5b< "What month?"

__ 1-12
98 Unknown
99 Refusal

>e_ProgNote47< *[Programming Note:*

If (>Exp_Resp2< not equal 3
*go to **>e_next_caco<**]*
Else if (>farmwork< not equal 1)
*go to **>rprevent1<***
End if]

>rchores_many< "During that >month_before<, would you say that you did as many chores or farmwork as were expected by the family, more chores or less chores than were expected?"

0 N/A – None were expected *(go to **>rprevent1<**)*
1 Did less than expected
2 Did about what was expected
3 Did more than expected
8 Unknown
9 Refusal

>rchores_well< "How well would you say that you performed the chores or farmwork that were expected by the family? Better than expected, about what was expected or worse than expected?"

1 Did worse than expected
2 Did about what was expected
3 Did better than expected
8 Unknown
9 Refusal

>rprevent1< "Do you believe that some farming or ranching operaton related injuries can be prevented?"

1 Yes
3 No *(go to **>rprevent3<**)*
8 Unknown *(go to **>e_next_caco<**)*
9 Refusal *(go to **>e_next_caco<**)*

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>rprevent2< "What are the two main things that you think can be done to prevent injuries that occur on the farm or ranch?" *[Enumerator: **Type response exactly as stated + end with ///.** After entering information, press ESC to continue with interview.]*

_____

*(go to **>e_next_caco<**)*

>rprevent3< "Why is it that you feel they can't be prevented?" *[Enumerator: **Type response exactly as stated + end with ///.** After entering information, press ESC to continue with interview.]*

_____

*(go to **>e_next_caco<**)*

Exit Module

>hh_end1< "Thank you very much for your time today. Goodbye."

1 *go to **>hh_exit<***

>ab_end2< "Thank you very much for your time today. Goodbye."

1 *go to **>ab_exit2<***

>i_end1< "Thank you very much for your time today. Goodbye."

1 *go to **>i_exit<***

>exp_the_end< "Thank you very much for your time today. Your cooperation gives us important information about factors that may prevent injuries, and may be used to develop injury prevention programs that will benefit all farm families. We will be calling your household again in approximately six months. We look forward to speaking with you then. GOOD-BYE."

>final_ProgNote< [Programming Note:
If (>controlHH< = 1 and >caseHH< = 0)
go to **>final_exit3<**
Else If (>controlHH< = 0 and >caseHH< = 1)
go to **>final_exit4<**
Else
go to **>final_exit5<**
End If]

>exp_end2< "Thank you very much for your time today. GOOD-BYE."

1 *Continue to **>exp_exit2<***

>callback< *[Enumerator: Setup callback. Press CONTROL-ENTER to go*

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to the appointment block. Remember to record the appointment on the call sheet.]

>hh_exit< *[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (1) REFUSED TO PARTICIPATE.]*

>hh_exit1< *[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (2) NO KIDS UNDER 19 IN HOUSEHOLD.]*

>i_exit< *[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (1) REFUSED TO PARTICIPATE DURING INJURY LOG.]*

>ab_exit1< *[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (4) ABBREV INTERVIEW - NO KIDS UNDER 19 IN HOUSEHOLD.]*

>ab_exit2< *[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (5) COMPLETED ABBREVIATED INTERVIEW.]*

>exp_exit2< *[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (8) REFUSED IN MIDDLE OF CASE-CONTROL.]*

>final_exit3< *[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (7)* COMPLETED INTERVIEW - CONTROL.*]*

>final_exit4< *[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (6)* COMPLETED INTERVIEW - CASE.*]*

>final_exit5< *[Enumerator: Use CONTROL-ENTER and select EXITMODULE. Reason for exiting (3)* COMPLETED - NOT A CASE OR CONTROL.*]*

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