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Do parents' perceptions of risks protect children engaged in farm work?

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Abstract

Background. The purpose was to describe farm parents' perceptions of risks on their farms and determine if these perceptions were associated with (1) using of the North American Guidelines for Children's Agricultural Tasks (NAGCAT) and (2) making NAGCAT-recommended changes to enhance the safety of farm work for their children.

Methods. This is a secondary analysis of data collected by telephone interview during a randomized trial that involved 450 farms in the United States and Canada.

Results. While 81% of farm parents perceived farming to be more dangerous than other occupations, only 66% of those parents felt that it was more dangerous for children to work on a farm than at other work. Furthermore, risk perception scores were only weakly associated with parents' use of NAGCAT and making NAGCAT-recommended safety changes.

Conclusion. Even with voluntary safety guidelines in hand and the general perception of farming as a dangerous occupation, many farm parents were not actively using NAGCAT to reduce the exposure of their children to hazardous farm work. Together with the continuing morbidity and mortality among farm children, this suggests that voluntary guidelines alone may not be sufficient to protect children working on farms.

Keywords: Agriculture; NAGCAT; Guidelines; Farm safety

Introduction

Youth working in agriculture have a 3-fold greater risk of death than young workers in the private sector [1], and nearly half of these work-related deaths occur to youth working on their family farm [2]. In 1998, more than 650,000 American children worked on the farm where they lived, and 72% of pediatric agricultural injuries that resulted in restriction of activities occurred to residents of the family farm [3].

The Fair Labor Standard Act (FLSA) protects youth working in agriculture by providing minimum age standards and hours that youth may work and identifies hazardous activities that are prohibited for youth under the age of 16 years [4,5]. Family farms are exempted from these child labor laws leaving parents responsible to judge what farm work is hazardous and decide on the extent of their child's involvement in that work.

There is evidence that parents do indeed assign dange-rous farm work to their children. The most common work activities reported for children are working with large animals and fieldwork involving tractors [6–8], and animals and machinery are the leading sources of injury and death for children [1,3,9–14]. So, why do farm parents expose their children to agricultural work when the risks are so great?

Abbreviations: FLSA, Fair Labor Standard Act; NAGCAT, North American Guidelines for Children's Agricultural Tasks; ROPS, rollover protection structures.

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There are both scientific and anecdotal reports that parents involve their children in farm work at an early age because they believe the benefits of having children involved in farm work outweigh the risk of injury [15,16], but what is missing from the biomedical literature are data about risk perceptions that may influence parents' decisions about the safety of their working children and associated work exposures. The purpose of this analysis was to explore farm parents' perceptions of risks and answer the following questions: do farm parents realistically perceive the dangers of the farm work environment, and if so, do they take action to make the farm work environment safer? Specifically, we proposed to describe farm parents' perceptions of risks on their farm and determine if their perceptions are associated with (1) use of a supplied safety resource, the North American Guidelines for Children's Agricultural Tasks (NAGCAT), and (2) making NAGCAT-recommended changes to enhance the safety of farm work for their children. This analysis informs agricultural safety specialists of parents' perceptions of risks and provides new direction for agricultural injury prevention strategies for working children.

Methods

Overview of study

The study involved a secondary analysis of data collected by telephone interview from parents who participated in a multisite randomized trial to evaluate the effectiveness of a NAGCAT dissemination. The randomized trial itself is described in detail elsewhere [17]. Farms were identified using the United States Department of Agriculture Master Sampling Frame, the Canadian Farm Registrar, and a commercially available agricultural database [18]. As part of the trial, parents were interviewed by telephone upon recruitment and during follow-up at 6 and 15 months. The current analysis was based upon the 15-month follow-up interviews conducted with 450 (90%) of the 498 farm parents originally recruited. This interview included questions that addressed parents' perceptions of risks as well as changes made on the farm to enhance safety for children.

The ethics committees of the Marshfield Clinic Research Foundation, University of California-Davis, and Queen's University at Kingston, Canada, each approved the original study protocol.

Assessment of risk perception

As part of the 15-month follow-up interview, farm parents were asked four questions about their general perceptions of risks on farms and ranches. Parents were asked to compare the risks of farming to those of other occupations, the risks of children working on a farm compared to the risks of children working in other environments, and the risks of children living on a farm compared to the risks of children of living in other non-farm environments. Parents were also asked if they thought children on their farm were at risk for injury. The questions were developed by consensus and pilot tested to achieve face validity with samples of farm parents in both the United States and Canada.

Use of NAGCAT

Newly released at the onset of our randomized trial, NAGCAT are voluntary guidelines to assist farm parents in assigning appropriate and safe work to their children 7–16 years of age. NAGCAT are based on child development principles and depict 62 common agricultural jobs in poster format. Each guideline includes a job illustration and list of adult responsibilities, hazards, safety reminders, recommended levels of supervision, and a developmental checklist [19]. The posters are grouped into booklets based upon job type and are categorized as follows: animal care, general activities, haying operations, implement operations, manual labor, specialty production, and tractor fundamentals (see www.nagcat.org). All farm families who volunteered to participate received copies of NAGCAT booklets.

The Transtheoretical Model of Behavior Change, commonly known as the Stages of Change model [20], provided

Table 1
Results for individual risk questions

	N[a]	Response[b]					
		Safer (0)		Same (1)		More dangerous (2)	
		N	%	*N*	%	*N*	%
R1. Risks of farming compared to other occupations	439	5	1.1	78	17.8	356	81.1
R2. Risks of children working on a farm as compared to other work	437	26	5.9	121	27.7	290	66.4
R3. Risks of children living on a farm as compared to other settings	438	81	18.5	168	38.4	189	43.2
		Disagree (0)				Agree (2)	
R4. Children on farm at risk for injury requiring treatment by doctor or nurse	430	194	45.1			236	54.9

[a] Numbers <440 reflect questions skipped by the responding parent.
[b] Numeric coding for risk score is shown in parentheses.

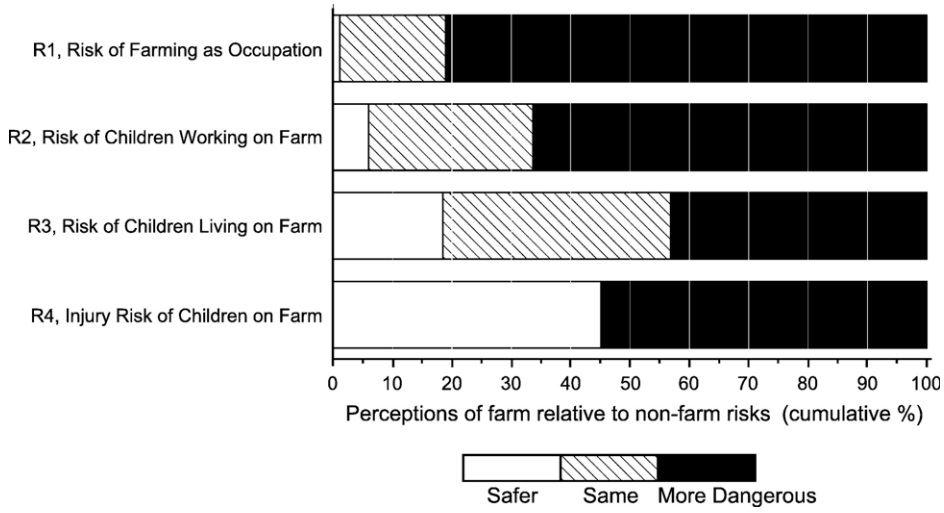

Fig. 1. Variation in parents' responses to individual risk questions.

the framework for measuring farm parents' use of NAGCAT. These stages were measured using a series of seven questions about prior and intended future use of NAGCAT. Parents in the action or maintenance stages were considered to be actively using NAGCAT to assign farm work to their children, while on the other end of the spectrum, parents in the precontemplation stage had no intention of using NAGCAT. The Stages of Change model has been shown to have high construct validity in a variety of contexts [20].

Assessment of NAGCAT-recommended safety changes

Fifteen months after receiving NAGCAT, farm parents were asked 10 questions about the NAGCAT-recommended changes made on their farm that resulted from participation in the study. Questions addressed both physical changes made on the farm and changes in the manner that children performed various jobs. Parents also had the opportunity to describe any other physical changes they made to their farm or any other changes they made in the way children perform jobs on their farm.

Analysis

A score reflecting the perceptions of risks was calculated by summing responses to the four risk questions; this score was scaled from 0% (lowest possible rating of risk) to 100% (highest possible rating of risk) to allow for the fact

Table 2
Perceptions of risks of farming as an occupation: general vs. specific to children

		R2. Risks of children working on a farm as compared to other work		
		Safer N	Same N	More dangerous N
R1. Risks of farming compared to other occupations				
	Safer	4	0	1
	Same	7	48	23
	More dangerous	15	73	265

24/436 = 5.5%
R2 > R1

95/436 = 21.8%
R1 > R2

317/436 = 72.7%
R1 = R2

Data show a highly significant difference in the two questions ($P < 0.001$).

that some parents completed only three of the four relevant questions. Farm safety changes were summarized as a count of the total out of 10 possible changes. Cronbach's alpha was used to assess the internal consistency of the questions within each of these summary scales, and this measure of consistency was found to be reasonably high in each case (risk perception $\alpha = 0.62$, safety changes $\alpha = 0.61$).

Descriptive summaries of the study data are presented in tables and graphics using standard summary statistics. The primary interest in this analysis was a description of the risk perception score—how it may vary by parental characteristics and its potential association with safety related actions taken by parents as measured by their stage of NAGCAT use and farm safety changes. Bivariate associations were measured with the Spearman rank correlation (r_s), and associations were tested for significance with adjustment for the stratified study design using the Cochran–Mantel–Haenszel statistic. A paired analysis of parents' assessment of the risk of farming as an occupation compared with their assessment of the risk of children working on a farm was based upon Bowker's [21] test of symmetry. Rank based tests were used to compare risk scores among groups.

Results

Of the 450 parents who completed the 15-month follow-up telephone interview, 8 respondents were excluded because no children were working on the farm, and 2 were excluded for not answering more than two questions

Table 3
Description of risk perception scores by design factors and parental and farm characteristics

	Perception of risk score				
	N[a]	Mean	Standard deviation	Min	Max
Total	440	71.9	23.7	0.0	100.0
Control	223	72.4	23.5	0.0	100.0
Experimental	217	71.4	23.9	0.0	100.0
Region					
Western USA	92	64.1	24.4	0.0	100.0
Midwestern USA	141	77.6	20.6	25.0	100.0
Ontario, Canada	207	71.5	24.5	0.0	100.0
Gender					
Male	172	75.1	22.6	0.0	100.0
Female	268	69.9	24.2	0.0	100.0
Age (years)					
<35	34	70.5	25.0	25.0	100.0
35–39	121	69.5	23.6	0.0	100.0
40–44	144	74.1	23.0	0.0	100.0
45–49	96	71.6	23.2	25.0	100.0
50+	44	73.3	26.9	0.0	100.0
Highest level of education					
High school or less	140	71.2	23.6	0.0	100.0
Some college/university	102	73.8	22.6	25.0	100.0
Complete college/university	191	71.7	24.6	0.0	100.0
Raised on a farm					
Yes	301	72.6	23.4	0.0	100.0
No	139	70.4	24.5	0.0	100.0
Involved in farm safety organizations					
Yes	155	71.2	22.6	0.0	100.0
No	283	72.2	24.3	0.0	100.0
Farm operation					
Full-time	345	72.6	23.4	0.0	100.0
Part-time/hobby	95	69.4	24.7	12.5	100.0
Commodity contribution					
Dairy cattle	110	74.5	23.0	25.0	100.0
Hogs/poultry/other livestock	137	70.3	22.6	25.0	100.0
Grain	103	77.6	20.8	25.0	100.0
Other	90	64.7	27.4	0.0	100.0
Percentage of tractors with reported ROPS					
0–50%	231	71.2	24.2	0.0	100.0
>50%	204	72.6	23.3	0.0	100.0
Percentage of PTO's with reported shields					
0–50%	29	67.7	25.1	25.0	100.0
>50%	395	72.5	23.5	0.0	100.0

[a] Responses that total to less than 440 within a classification reflect responses that are missing or in categories not shown due to small frequencies.

regarding safety changes. The remaining 440 surveys were analyzed.

Parents' risk perception on their farm

Results for the individual risk questions are shown in Table 1, and Fig. 1 illustrates the variation in parents' responses. Eighty-one percent of parents perceive farming to be more dangerous than other occupations, while only 66% of parents perceive farm work to be more dangerous for their children than other work. Even fewer perceive their children to be at risk for injury on the farm. As shown in Table 2, this reflects a significant shift in perceptions of risks ($P < 0.001$). Nearly 22% of parents rated the general risks of farming compared to other occupations higher than they rated the specific risks of children working on a farm compared to other work, while only 5.5% of parents rated the specific risks of working children higher than the general risk.

The risk perception scores are summarized in Table 3. They ranged from 0% to 100% and, in general, were quite high with a mean of 72%. A total of 104 parents (24%) scored 100%, indicating they had acknowledged the highest possible risk. Scores varied somewhat by study region and commodity, as well as by gender of the respondent. Perception of risk scores did not vary by significantly parents' level of formal education nor whether they were raised on a farm or involved in farm safety organizations. Likewise, scores did not vary significantly by the number of tractors equipped with rollover protection structures (ROPS) and shielded power take-offs.

Parents' perceptions of risks and use of NAGCAT

Fig. 2 illustrates parents' risk perception scores by their use of NAGCAT. The largest proportion of parents were in the action stage (191/440, 43%) and tended to have higher risk perception scores ($P = 0.011$). However, the association was weak ($r_s = -0.11$) with a large range of scores for each stage of use. Even among the 104 parents who perceived the most risk possible (risk perception scores of 100%), 50 (48%) were not actively using NAGCAT.

Parents' perceptions of risks and NAGCAT-recommended safety changes

Fifteen months after receiving the intervention, parents reported making between 0 and 10 NAGCAT-recommended safety changes, and the majority made between 2 and 5. The most common safety changes were preventing a child from doing a job (67%) and increasing supervision of children (63%) (Table 4). Fewer parents reported making a physical change to enhance the safety of farm work for their children, such as adding/repairing shields (36%), purchasing a special tool (22%), or adding ROPS to a tractor used by a child (4.5%).

Fig. 3 illustrates parents' perception of risk scores by the number of changes made on the farm. Risk perception scores tended to be higher for farm parents who made more safety changes ($P = 0.012$), but the association was weak ($r_s = 0.12$). There was substantial variability in the scores regardless of the number of safety changes reported.

Discussion

This secondary analysis examined farm parents' perceptions of risks on the farm and the association between these perceptions and changes made to improve the safety of farm work for their children. The majority of farm parents perceived farming to be dangerous for their working children; however, perceptions of risks did not necessarily translate into safety action. Risk perception scores were only weakly associated with parents' use of NAGCAT and NAGCAT-recommended safety changes they reported making on the farm.

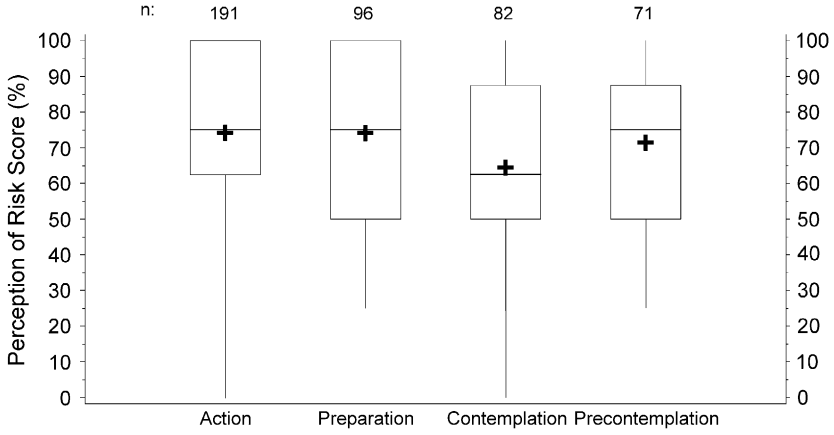

Fig. 2. Perception of risk score by stage of guidelines usage. Boxes extend from the 25th to 75th percentiles, with a line at the median and a "+" at the mean. Vertical lines extend to the minimum and maximum.

Table 4
Individual changes made on the farm

Changes made on the farm	Respond Yes	
	N[a]	%
Prevented child from doing job	294	66.8
Provided more supervision to child	276	62.7
Set limit on amount of time worked	207	47.0
Used smaller container for carrying feed	163	37.0
Added/repaired shield on machinery	158	35.9
Any other changes in way children perform jobs[b]	127	28.9
Added new job for child to do	117	26.6
Purchased new tool to be used by child	95	21.6
Made any other changes to farm[c]	76	17.3
Added ROPS to tractor used by child	20	4.5

[a] Total $N = 440$.
[b] More rules, instruction, use of personal protection equipment.
[c] Constructed gates and pens, cleaned-up hazards.

Consistent with our findings, a study conducted by Elkind [22] found that Washington farmers' knowledge of farm hazards was unrelated to the safety precautions they took to protect themselves. Among the majority of farmers who took some safety precautions, Elkind's study also revealed that there was no significant difference in the degree to which they considered agriculture to be a dangerous occupation. Perceptions and knowledge of farm hazards did not appear to motivate farmers to protect themselves. In considering the safety of children, we expected that parents' perceptions of risks would have greater influence on their decisions to protect children working on their farm. Our results indicate that this is not the case.

In our analysis, the majority of farm parents perceived farming to be more dangerous than other occupations, yet substantially fewer thought it was more dangerous for children to work on the farm than to work in other settings, and even fewer perceived their children to be at risk for a farm injury. Similarly, in Elkind's [22] analysis of the farm parents in Washington who perceived farming to be more dangerous than other occupations, 90% would not discourage their children from farming.

Lee et al. [15] explored factors that influenced farm fathers to expose their children to hazardous activities on the farm. They found that the desire for the child to gain work experience, develop a strong work ethic, build self-confidence, and spend family time together during work activities were strongly associated with farm fathers' intention to expose children to hazardous work. The researchers concluded: "farm parents have noble reasons for involving their children in farm tasks at an early age and justify risk of injury based on the potential benefit to the child" (p. 213). These beliefs undoubtedly put many farm children at risk for injury.

In a recent qualitative study exploring farm parents' practices regarding employment, training, and supervision of their children, researchers found that farm parents unanimously agreed on the benefits of farm work for children [16]. Benefits that farm parents cited included the development of a work ethic and sense of responsibility, teaching useful knowledge and skills, teaching about cooperation and teamwork, and bringing the family closer together. Indeed, farm parents believe that these benefits outweigh the risks of farm work [16].

Although the information presented here was from nonvalidated self-reports, it is encouraging that 90% of farm parents in this analysis reported making at least one NAGCAT-recommended change to their farm in order to make the jobs safer for their children. The majority of the changes parents made involved altering the way the child did the job rather than making changes requiring monetary investments like purchasing new tools or adding rollover protection structures (ROPS) to a tractor used by a child.

One strength of this analysis is the availability of a large and geographically diverse sample. However, the primary aim of the randomized trial was to evaluate dissemination of a safety resource, not to measure perceptions of risks, and a different methodological approach may have been employed if the assessment of perceptions had been the primary focus of the trial. One must also consider that our instrument was

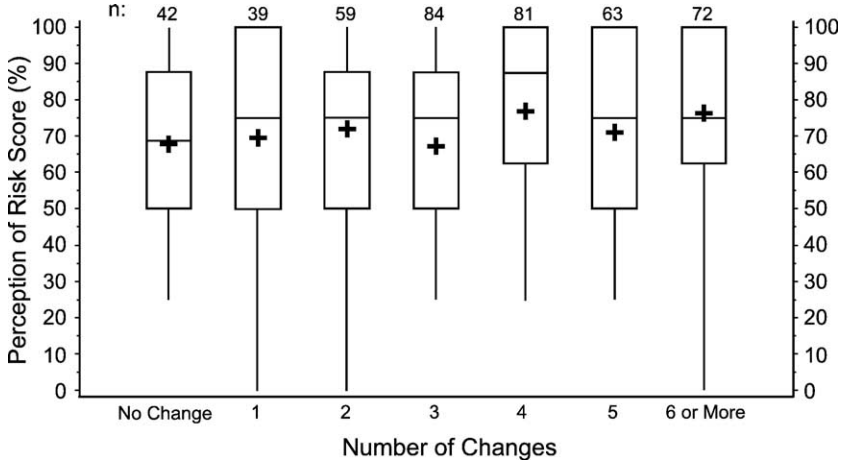

Fig. 3. Perception of risk score by number of changes made on farm. Boxes extend from the 25th to 75th percentiles, with a line at the median and a "+" at the mean. Vertical lines extend to the minimum and maximum.

new and that parents were asked to compare a specific industry (farming) to other occupations collectively. Different parents might well be thinking about different types of comparative industries when answering these questions. This imprecision in measurement may have led to some misclassification of responses, and hence the differences observed in our analyses should be viewed as conservative. Further, parents who participated in the 15-month follow-up interview may represent the most devoted of all participants in the randomized trial. Therefore, these findings may not represent the perceptions of farm parents who did not volunteer to participate in the trial or who did not complete the trial once recruited.

Even with voluntary safety guidelines in hand and the general perception of farming as a dangerous occupation, many farm parents were not actively using NAGCAT to reduce the exposure of their children to hazardous farm work. The majority of farm parents perceive the dangers of farm work, but even among the parents who perceived the highest possible risk, nearly half were not using NAGCAT. In addition, perceptions of risks showed little association with NAGCAT-recommended changes to enhance the safety of farm work for children. Regardless of the reasons, it is clear from the continued morbidity and mortality among farm children that farm parents do not always make safe decisions regarding their working children. In order to really keep children safe on the farm, they must be restricted from doing the most hazardous work. If voluntary guidelines alone are not sufficiently effective, it may be time to consider legislated standards for making farm work safer for all children.

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References

[1] Hard D, Myers J, Snyder K, et al. Young workers at risk when working in agricultural production. Am J Ind Med 1999;S1:31–3.
[2] Castillo DN, Adekoya N, Myers JR. Fatal work-related injuries in the agricultural production and services sectors among youth in the United States, 1992–96. J Agromedicine 1999;6:27–41.
[3] Myers JR, Hendricks KJ. Injuries among youth on farms in the United States, 1998. DHHS [NIOSH] Publ, no. 2001-154. Cincinnati (OH): National Institute for Occupational Safety and Health; 2001 [Available at http://www.cdc.gov/niosh/childag/pdfs/2001154.pdf. Accessed January 28, 2004].
[4] U.S. Department of Labor. Child labor requirements in agriculture under the Fair Labor Standards Act. Child Labor Bull, no. 102. Washington (DC): U.S. Government Printing Office; 1990 [Available at http://www.abe.iastate.edu/safety/clb102.htm. Accessed January 28, 2004].
[5] U.S. Department of Labor. Child labor regulations, orders, and statements of interpretation. Fed Regist, vol. 35. p. 4 [Available at http://a257.g.akamaitech.net/7/257/2422/14mar20010800/edocket.access.gpo.gov/cfr_2002/julqtr/29cfr570.70.htm. Accessed January 28, 2004].
[6] Browning SR, Westneat SC, Szeluga R. Tractor driving among Kentucky farm youth: results from the farm family health and hazard surveillance project. J Agric Saf Health 2001;7:155–67.
[7] Marlenga B, Pickett W, Berg RL. Agricultural work activities reported for children and youth on 498 North American farms. J Agric Saf Health 2001;7:241–52.
[8] Marlenga B, Pickett W, Berg RL. Assignment of work involving farm tractors to children on North American farms. Am J Ind Med 2001;40:15–22.
[9] Gerberich SG, Gibson RW, French LR, et al. Injuries among children and youth in farm households: regional rural injury study-I. Inj Prev 2001;7:117–22.
[10] Pickett W, Hartling L, Brison RJ, Guernsey JR. Fatal work-related farm injuries in Canada, 1991–1995. Canadian agricultural injury surveillance program. CMAJ 1999;160:1843–8.
[11] Pickett W, Hartling L, Dimich-Ward H, et al. Surveillance of hospitalized farm injuries in Canada. Inj Prev 2001;7:123–8.
[12] Mandryk J, Harrison J. Work-related deaths of children and adolescents in Australia, 1982 to 1984. Aust J Public Health 1995;19:46–9.
[13] Layde PM, Nordstrom DL, Stueland D, Wittman LB, Follen MA, Olson KA. Animal-related occupational injuries in farm residents. J Agric Saf Health 1996;2:27–37.
[14] Stueland D, Layde P, Lee BC. Agricultural injuries in children in central Wisconsin. J Trauma 1991;31:1503–9.
[15] Lee BC, Jenkins LS, Westaby JD. Factors influencing exposure of children to major hazards on family farms. J Rural Health 1997;13:206–15.
[16] Neufeld S, Wright SM, Gaut J. Not raising a "bubble kid": farm parents' attitudes and practices regarding the employment, training and supervision of their children. J Rural Health 2002 (Winter); 18:57–66.
[17] 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. Prev Med 2002;35:150–9.
[18] The APC farming database. Toronto: Agricultural Publishing Company (APC) Farming Database CO; 1999.
[19] Lee B, Marlenga B, editors. Professional resource manual: North American guidelines for children's agricultural tasks. Marshfield (WI): Marshfield Clinic; 1999.
[20] Prochaska JO, Johnson S, Lee P. The transtheoretical model of behavior change. In: Shumaker SS, Schron EB, editors. The handbook of health behavior change. Second ed. New York: Springer Publishing Co.; 1998. p. 59–84.
[21] Bowker AH. A test for symmetry in contingency tables. J Am Stat Assoc 1948;43:572–4.
[22] Elkind PD. Correspondence between knowledge, attitudes, and behavior in farm health and safety practices. J Safety Res 1993;24: 171–9.