Gender Division of Farm Work and Occupational Injuries

J. P. Karttunen, R. H. Rautiainen, E. Quendler

ABSTRACT. *Several studies have shown that males are at greater risk of agricultural injuries than females. We investigated if gender division of farm work helps explain this risk difference in the self-employed Finnish farming population. We used insurance claims data and postal survey data charting the relative division of farm work between male and female farmers. Over the five-year study period (2009 to 2013), the average number of farmers was 75,893 (67% males and 33% females). A total of 22,648 occupational injuries (77% males and 23% females) were compensated during that time. Males had significantly higher rates of any, minor, serious, and recurrent injuries compared to females. Altogether, 319 usable responses were received in the postal survey (13% response rate). Both farm work time and occupational injuries differed by gender. Crop production, construction, forestry, and machinery contracting work were male-dominated, whereas females took the main responsibility for domestic and caretaking work. On livestock farms, animal husbandry was divided quite evenly between males and females (56% and 44% contributions, respectively). Animal husbandry-related injuries were distributed similarly (58% males and 42% females), but all other types of injuries occurred mostly to males. These results suggest that the risk of injuries is also nearly equal, given equal work time. Therefore, gender is an indicator of different work exposures in farming, rather than a risk factor for injury. Better understanding of the division of work and the corresponding risk of injuries can help in the design of interventions for males and females in agriculture.*

Keywords. *Agriculture, Claim, Exposure, Farmer, Gender, Insurance, Occupational injury, Work.*

Occupational injuries are frequent in agriculture worldwide (ILO, 2019). A growing body of literature has focused on the characteristics of and risk factors for occupational injuries in farming (Van den Broucke and Colémont, 2011; Karttunen and Rautiainen, 2013a; Kogler et al., 2015). Meta-analyses by Jadhav et al. (2015, 2016) revealed significant risk factors for agricultural injury, including full-time farming, farm owner status, history of prior injuries, regular medication use, hearing loss, and stress or depression. Male gender is consistently a risk factor for occupational injuries in farming.

Differences have been detected in self-reported health and safety perceptions between

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The authors are **Janne P. Karttunen,** Principal Research Scientist, TTS Work Efficiency Institute, Rajamaki, Finland; **Risto H. Rautiainen,** Professor, Department of Environmental, Agricultural, and Occupational Health, University of Nebraska Medical Center, Omaha, Nebraska, and Principal Research Scientist, Natural Resources Institute Finland, Helsinki, Finland; **Elisabeth Quendler,** Associate Professor, Department of Sustainable Agricultural Systems, University of Natural Resources and Life Sciences, Vienna, Austria. **Corresponding author:** Janne P. Karttunen, TTS Work Efficiency Institute, P.O. Box 5, 05201 Rajamaki, Finland; phone: +358-44-7143689; e-mail: janne.karttunen@tts.fi.

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male and female farmers (Pickett et al., 2015; Stoneman and Jinnah, 2017). Further, gender has been suggested as an indicator of different exposure, rather than a risk factor for injury (Dimich-Ward et al., 2004). Andersson and Lundqvist (2014) stressed the need to take exposure into account when studying gender-based safety issues in agriculture. However, agricultural exposures are difficult to measure due to the seasonal nature and variability of farm work, as well as mixed exposure situations (Kromhout and Heedrik, 2005). Indicative information is available on the division of farm work and occupational injuries between genders on Finnish dairy farms (Karttunen and Rautiainen, 2013b).

Our study aimed to investigate the gender division of farm work and occupational injuries in the self-employed Finnish farming population covered by statutory workers' compensation insurance. This information can be used to generate recommendations for the prevention of occupational injuries among present and future farmers and farm workers in Finland and elsewhere.

Materials and Methods

This study was built on an earlier survey study by Karttunen and Tuure (2013), which charted the division of work on conventional farms and diversified farms in Finland in 2011. Conventional farms were engaged in agriculture and forestry; nearly all Finnish farms (93%) owned forest (Luke, 2012a). Diversified farms were engaged in other gainful activities in addition to agriculture and forestry, such as machinery contracting or farm tourism. About one-third of farms (31%) practiced diversified entrepreneurship in 2011 (Luke, 2012b).

These survey data were combined with administrative insurance data obtained from the Farmers' Social Insurance Institution (Finnish acronym: Mela). These data are used in the administration of pension and accident insurance schemes at Mela. No additional data collection was carried out for this study. The research datasets included no personal identifiers. Confidentiality was described in a signed agreement between Mela and the authors in accordance with Finnish laws governing the use of insurance data for research.

Study Setting and Subjects

Finnish agriculture is based on family farming. The self-employed farming population includes farmers, spouses, and other salaried family members. For brevity, these persons are all referred to here as "farmers". They composed approximately 90% of the workforce in Finnish agriculture in 2010. Hired non-family workers and farm relief workers with permanent contracts composed the rest of that workforce (Luke, 2012c; Mela, 2019a).

The self-employed farming population between the ages of 18 and 67, from farms with at least 5 ha (12.4 acres) of owned or rented farmland, and with a defined farm income of ≥3,900 Euros (in 2019) must obtain statutory pension insurance and accident insurance against occupational injuries and diseases (Mela, 2018). Smaller farms may obtain these insurances voluntarily. These insurance schemes cover both full-time and part-time farmers. Other workers' compensation insurance carriers cover hired non-family workers and farm relief workers.

Finnish farmers are accustomed to indicating their primary subsector for various information sources. A combination of livestock and various crops, typically augmented with forestry, has traditionally been common on Finnish farms, but structural changes in farming are altering this situation. During the 2010s, the number of farms in general, and particu-

larly livestock farms, has declined (Luke, 2019). Because the remaining farms have enlarged their field area, their livestock operation, or both, the total agricultural production and the proportion of full-time farmers have remained about the same (Luke, 2019).

Research Data

The insurance data provided by Mela covered all compensated occupational injury claims requiring medical care in the self-employed Finnish farming population over a five-year period (2009 to 2013). These data included the gender of the insured person, the number of disability days, and the work activity code for the person at the time of injury for each claim. This work activity code contains five main categories, 23 subcategories, and 151 specific work tasks. The results are reported primarily at the main category level.

The claims data were augmented with data from a postal survey by Karttunen and Tuure (2013), which contained questions about the division of farm and domestic work on Finnish farms in 2011. The postal survey was addressed to the primary operators of the farms, who were mostly males (Luke 2012c). Participation in the survey was voluntary. Farmers were asked to estimate the relative contribution to various work activities between insured and non-insured farmers, spouses, other members of the farm family, contract workers, and hired workers. Estimations were solicited with an accuracy of about 10% for each contributor so that the sum of the contributions would equal 100% for each work activity. This article focuses on the division of work between male and female members of the farm family who were insured by the workers' compensation insurance.

Statistical Methods

The data analysis included calculating the frequency distributions of compensated occupational injury claims. The differences in the relative proportions of any, minor, serious, and recurrent injuries between genders were compared using two-tailed chi-square tests. Only statistically significant differences are reported ($p < 0.05$). The distribution of compensated injury claims by severity and work activity code and the division of farm work between genders were calculated using Microsoft Excel Office 365. Other statistical analyses were conducted using SPSS Statistics (ver. 22, IBM Corp., Armonk, N.Y.).

Results

Based on the annual insurance records of Mela (2019b), the self-employed Finnish farming population with statutory workers' compensation insurance declined from 81,146 in 2009 to 70,445 in 2013. Simultaneously, the proportion of male farmers increased from 66.4% to 67.6%. The average number of farmers within this five-year period was 75,893 (66.9% males and 33.1% females).

From 2009 to 2013, a total of 22,648 occupational injury claims were compensated to this population, for an average annual rate of 6.0 cases per 100 persons (6.9/100 for males and 4.2/100 for females). Of these claims, 16,511 (72.9%) were for minor injuries, causing at most 30 compensated disability days, and 6,137 (27.1%) were for serious injuries, causing 31 or more compensated disability days.

Characteristics and Division of Injuries

The distribution of compensated occupational injuries among the self-employed Finnish farming population during 2009 to 2013 is presented in table 1. Males had significantly higher rates of any, minor, serious, and recurrent (≥2) occupational injuries compared to

Table 1. Distribution of compensated occupational injuries among the self-employed Finnish farming population from 2009 to 2013 by type of injury and gender. Values are numbers (and percentages in parentheses); percentages add up horizontally across rows.

Type of Injury	Males[a]	Females[a]	All Farmers
Any injury	11,793 (76.3)	3,653 (23.7)	15,446 (100.0)
One or more minor injuries[b]	9,091 (76.5)	2,797 (23.5)	11,888 (100.0)
One or more serious injuries[b]	4,086 (76.2)	1,276 (23.8)	5,362 (100.0)
Recurrent (≥2) injuries	3,302 (77.0)	988 (23.0)	4,290 (100.0)

[a] For each type of injury, the difference between the relative proportions of male and female farmers is significant (chi-square test, $p < 0.001$).

[b] Minor injuries cause at most 30 compensated disability days, and serious injuries cause 31 to 365 compensated disability days (longer cases converted to injury pension).

females (chi-square test, $p < 0.001$). Altogether, 4,290 farmers had recurrent injuries (range of 2 to 15 injuries per person) in the five-year period.

Compensated occupational injury claims were classified into five main work activity categories (table 2): animal husbandry, crop production, forestry work, construction work, and other farm work. All main categories included sub-categories. Specific work task codes

Table 2. Number and percentage of compensated occupational injuries among the self-employed Finnish farming population from 2009 to 2013 by farm work activity at the time of injury, gender, and severity.

Main Category of Farm Work Activity at Time of Injury[a]	Number of Occupational Injuries (and Relative Percentage)[b]						
		Males			Females		
	Total	Minor[c]	Serious[c]	All	Minor[c]	Serious[c]	All
Animal husbandry	9,566 (100.0)	4,130 (73.8)	1,465 (26.2)	5,595 (58.5)	2,912 (73.3)	1,059 (26.7)	3,971 (41.5)
Crop production	3,205 (100.0)	2,033 (72.7)	762 (27.3)	2,795 (87.2)	267 (65.1)	143 (34.9)	410 (12.8)
Forestry work	2,144 (100.0)	1,403 (70.9)	576 (29.1)	1,979 (92.3)	122 (73.9)	43 (26.1)	165 (7.7)
Construction work	1,121 (100.0)	734 (70.4)	308 (29.6)	1,042 (93.0)	57 (72.2)	22 (27.8)	79 (7.0)
Other farm work: Repair and maintenance of machines	3,231 (100.0)	2,407 (77.5)	699 (22.5)	3,106 (96.1)	92 (73.6)	33 (26.4)	125 (3.9)
Other farm work: Farmstead and road maintenance including snow removal	507 (100.0)	297 (64.6)	163 (35.4)	460 (90.7)	36 (76.6)	11 (23.4)	47 (9.3)
Other farm work: Preparation of firewood or woodchips	416 (100.0)	258 (70.5)	108 (29.5)	366 (88.0)	34 (68.0)	16 (32.0)	50 (12.0)
Other farm work: Work tasks related to diversified entrepreneurship[d]	476 (100.0)	263 (70.1)	112 (29.9)	375 (78.8)	74 (73.3)	27 (26.7)	101 (21.2)
Other farm work tasks[e]	1,966 (100.0)	1,178 (69.9)	507 (30.1)	1,685 (85.7)	200 (71.2)	81 (28.8)	281 (14.3)
Unknown work activity	16 (100.0)	14 (87.5)	2 (12.5)	16 (100.0)	NC	NC	NC
Total	22,648 (100.0)	12,717 (73.0)	4,702 (27.0)	17,419 (76.9)	3,794 (72.6)	1,435 (27.4)	5,229 (23.1)

[a] The work activity code contains five main categories, 23 subcategories, and 151 individual work tasks.

[b] Relative percentage indicates the number of compensated injuries to males or females and the number of minor or serious injuries divided by the number of all injuries in each category. NC = none compensated.

[c] Minor injuries cause at most 30 compensated disability days, and serious injuries cause 31 to 365 compensated disability days.

[d] "Diversified entrepreneurship" includes gainful activities in addition to agriculture and forestry, such as machinery contracting or farm tourism.

[e] "Other farm work tasks" includes injuries from 27 individual work tasks.

were also available. The claim was classified as "unknown work activity" if the work activity code was missing.

Work activities related to animal husbandry accounted for the largest share of both minor and serious injuries. The main category "other farm work" accounted for the second largest share of injuries and its subtask "repair and maintenance of machines" accounted for 3,231 injuries (14.3% of all injuries), more than any other specific work task.

The relative percentage of the serious occupational injury claims was on average 27.1% and was highest for work tasks related to construction work (29.4% of all injuries), followed by forestry work (28.9%), crop production (28.2%), "other farm work" (26.6%), and animal husbandry (26.4%). However, "repair and maintenance of machines" had a relatively low percentage of serious injuries (22.7%), whereas the subtask "farmstead and road maintenance including snow removal" had a high corresponding percentage (34.3%).

Occupational injuries differed by gender. Except for animal husbandry-related injuries, all other injuries occurred mostly to males, and their relative share varied from 87% to 96%. Animal husbandry-related injuries were divided more evenly between males and females: 58% and 42%, respectively.

Division of Farm Work

Altogether, 319 usable responses to the postal survey were received (13% response rate). Most of the participants (87%) were male. The mean age of the participants was 51 years. Most participants (85%) were members of a farm family that had two or more (range of 1 to 6) insured members contributing to the farm's work. Typical farms were operated by one male and one female farmer.

Over half of the participants (58%) had a crop farm, and the rest had a livestock farm. Further, over half (56%) had a diversified farm, and the rest had a conventional farm. Diversified farms typically practiced (in descending order) machinery contracting, farm tourism, bio-energy production, or provided care services. The average field area of the farms was 45 ha.

Based on the survey data, farm work time differed by gender. In general, crop production, forestry work, farm building maintenance and repair (i.e., construction work), and a few other farm work tasks, including farm management, were dominated by males, while females took the main responsibility for domestic work and caretaking of children or elderly parents (table 3). Animal husbandry was divided more evenly between males and females, with relative work contributions of 56% and 44%, respectively.

Combined Data

The combination of farm work activity data and insurance claims data by gender is presented in figure 1. These data indicated a gender division of farm work and occupational injuries. Crop production, forestry work, construction work, and a few other farm work tasks, including diversified entrepreneurship, and corresponding injuries were male-dominated, whereas work tasks and injuries related to animal husbandry were divided quite evenly between males and females.

The difference between the percentage of relative work contribution and corresponding injuries by gender and farm work activity varied from 0% to 3% with one exception. Work tasks related to farmstead and road maintenance accounted for clearly more injuries to males than their relative work contribution suggested, 91% versus 84%, respectively.

Table 3. Division of farm work between Finnish farmers from a total of 319 farms in 2011.

Description of Work Activity	Number of Farms	Percentage of Relative Work Contribution[a]	
		Males[b]	Females[b]
Animal husbandry excluding maintenance and repair of machines	101	56	44
Crop production excluding maintenance and repair of machines	274	90	10
Forestry work including tending of seedling stands	260	90	10
Farm building maintenance and repair	276	91	9
Repair and maintenance of machines	269	96	4
Farmstead and road maintenance	275	84	16
Preparation of firewood or woodchips	264	88	12
Work tasks related to diversified entrepreneurship[c]	109	81	19
Farm management[d]	275	74	26
Domestic work[e]	252	35	65
Caretaking of children or elderly parents	161	38	62

[a] Farmers were asked to estimate relative work contributions with an accuracy of about 10%. Each row includes only accurate responses where the sum of contributors' shares equals 100%.

[b] Males and females with workers' compensation insurance.

[c] "Diversified entrepreneurship" includes gainful activities in addition to agriculture and forestry, such as machinery contracting or farm tourism.

[d] Includes, among other activities, cultivation and feed planning, preparing tax returns, farm subsidy applications, financial and livestock accounting, gathering of information, and payment of farm bills.

[e] Includes, among others activities, cooking, clothing care, housekeeping, groceries, banking, and gardening.

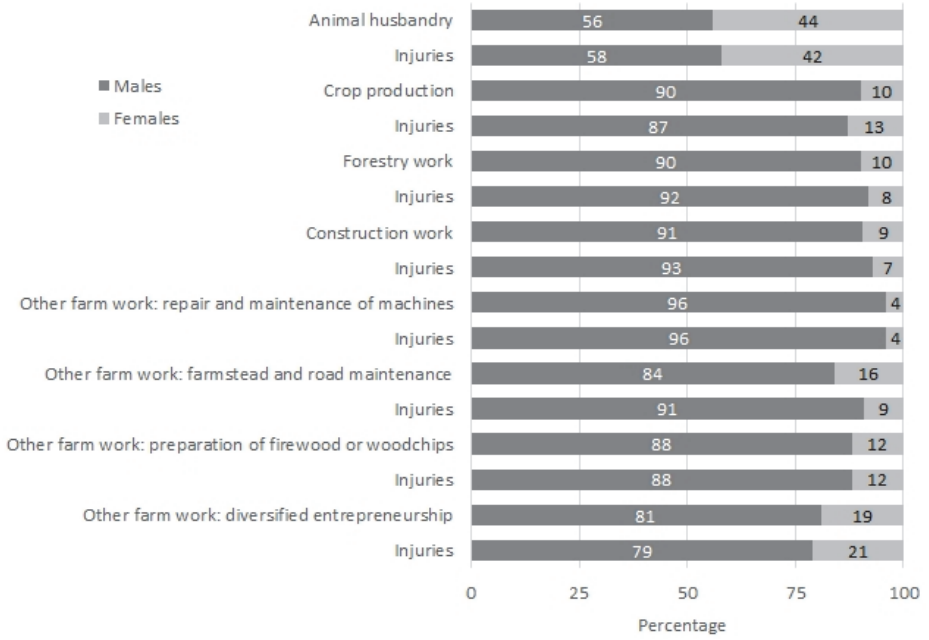

Figure 1. Division of farm work activities in 2011 and corresponding occupational injuries from 2009 to 2013 among the self-employed Finnish farming population.

Discussion

The material used in this study consisted of insurance claims data for the self-employed Finnish farming population augmented with data from a postal survey charting the relative division of farm and domestic work between male and female members of farming families. Both datasets included persons with statutory workers' compensation insurance. The insurance records covered all compensated occupational injury claims requiring medical care over a five-year period from 2009 to 2013, and the postal survey data covered the year 2011, i.e., the middle year of the insurance records.

In Finland, the statutory pension and accident insurance schemes for farmers, administered by Mela, cover practically the entire self-employed farming population, including farmers, spouses, and other salaried family members. This population has a financial incentive to claim their occupational injuries and diseases, and a well-established legal framework is in place to guide insurance practices. However, an insurance premium discount system (i.e., a no-claims bonus in place from 1997 to 2015) may have resulted in under-reporting of minor injuries (Rautiainen et al., 2005).

Comparison with Previous Studies

Based on our results, farm work time and occupational injuries differed by gender, as Dimich-Ward et al. (2004) also concluded. In general, animal husbandry and corresponding injuries were shared quite evenly between genders on livestock farms. All other farm work activities, including diversified entrepreneurship (machinery contracting in particular), and corresponding injuries were mostly male-dominated. On most farms, females took the main responsibility for domestic work and caretaking work, which are not covered by the statutory workers' compensation insurance. Management tasks were mostly male-dominated, but corresponding injuries were not examined in this study.

We acknowledge the importance of domestic work, caretaking work, and off-farm employment when studying the gender division of work on farms. Among others, Pickett et al. (2015), Contzen and Forney (2017), and Elliot et al. (2018) studied these typically female-dominated areas, which were beyond the scope of our study due to the lack of insurance data.

Gender division of farm work inevitably results in differences in both the quality and quantity of exposure to occupational injuries and diseases. This issue was stressed by Andersson and Lundqvist (2014), who reviewed the gendered understanding of occupational health and safety in farming. They found that separating the domestic and occupational environments on farms is often difficult, especially regarding health and safety issues.

On the basis of our results, we strongly agree with McCoy et al. (2002) and Dimich-Ward et al. (2004), who stated that gender is an important factor in farm injury prevention. Differences have been detected in the self-perceived health (Pickett et al., 2015) and safety (Stoneman and Jinnah, 2017), among other topics, of male and female farmers. These all are important issues when designing more effective interventions.

Our survey results covering 319 livestock or crop farms are consistent with and add evidence to the findings of Karttunen and Rautiainen (2013b), who conducted a case-control study among 31 dairy farm couples. However, the gender division of farm work and related injuries was a side topic in that study, which stressed that information on task-based injury and illness rates could help in designing interventions.

In our study, serious injuries causing at least 31 disability days were common in many

of the male-dominated work activities, with one exception: the relative percentage of serious injuries was low in repair and maintenance of machines. Farmstead and road maintenance including snow removal stood out as the male-dominated work activity with the highest relative percentage of serious injuries among the studied work activities.

On livestock farms, both genders contributed notably to animal husbandry, which accounted for the largest number of injuries for males and females. However, the relative percentage of serious injuries was lower in animal husbandry than in many other work activities. While females contributed modestly to crop production, it stood out with the highest relative percentage of serious injuries for females.

These results are in accordance with Karttunen (2014), who examined, among other topics, the severity of occupational injuries and diseases compensated to a specific group of Finnish farmers (n = 78,679) over a five-year period from 2000 to 2004. His study listed work activities and statistical causes of occupational injuries and diseases based on their absolute and relative percentages.

This study concurs with Karttunen (2014, 2018) that, on livestock farms, animal husbandry stands out as the most injury-prone work activity, not only for male and female farmers but also for hired workers and farm relief workers. However, in terms of the relative percentage of serious injuries, almost all other farm work activities should be of concern, particularly for male farmers regardless of their primary subsector of farming.

On Finnish farms, most serious occupational injuries are caused by external causes related to the indoor or outdoor working environment, production animals, and agricultural machinery and equipment (Karttunen, 2014). However, statistical causes alone may not provide enough information for successful prevention, as stressed by Mayrhofer et al. (2014) and Kogler et al. (2015). The latter study included a detailed analysis of injury-causing human-machine interactions.

In Mela's coding system, each main category of farm work includes several subcategories and individual work tasks. For example, animal husbandry is divided into seven subcategories and 42 individual work tasks. Based on our findings and supported by the results of Karttunen (2014), it is plausible that as-yet undetected male- or female-dominated work tasks exist under the main category level that account for a large share of injuries in general and serious injuries in particular. Future studies, conducted with an up-to-date structure of farm work, should examine individual farm work tasks more closely regarding the gender distribution as well as the severity of occupational injuries and diseases.

To summarize, our study detected a gendered division of farm work and occupational injuries in the self-employed Finnish farming population. While the meta-analysis by Jadhav et al. (2016) indicated that males have greater risk of injury than females, our study showed that the risk of injury was nearly equal, given equal work time. Therefore, gender is an indicator of different work exposures in farming, rather than a risk factor for injury. This finding can contribute to better understanding of the risk of occupational injury among farming populations and could help in the design of more effective interventions.

Strengths and Limitations of the Study

The strengths of this study included the availability of a large dataset for a well-defined population, covering compensated occupational injuries over a five-year period. This data source is a well-established total population-based insurance system. These longitudinal data enabled comprehensive identification of injury characteristics, including their severity

and division between genders. Investigation of the severity of the injuries adds new information to previous knowledge based on surveys and accident insurance (workers' compensation) data.

To our knowledge, no other comprehensive studies are available that have examined both the gender division of farm work and compensated occupational injuries for an entire self-employed farming population at a national level. In addition, our study produced new information on the gender division of diversified entrepreneurship and related injuries.

The low response rate (13%) to the postal survey is a significant limitation of our study and may have introduced participation or non-response bias. In addition, many participants provided only partial data to the study due to inaccuracies regarding one or more of the work activities. Active farmers in Finland have a high record-keeping and reporting burden. This may have contributed to the low participation.

On average, the participants reported a larger field area than the average for all Finnish farms in 2011: 45 versus 37 ha, respectively (Luke, 2012a). In addition, diversified farms (56% vs. 33%) and livestock farms (42% vs. 34%) were over-represented among the participants in comparison to all Finnish farms (Luke, 2012b, 2012d). These issues may have introduced some biases, and which way they may have affected the results is unknown. However, the age distribution of the participants (mean age of 51) was similar to that of the owner-operators of all Finnish farms in 2011 (mean age of 51) (Luke, 2012e). In addition, our primary findings are consistent with the earlier results of Karttunen and Rautiainen (2013b).

The subjective estimates of the relative work contributions in the postal survey is another limitation of our study. In addition, the majority of the participants were males. Having more female participants and more precise working hour data could have improved the accuracy of the responses. However, reliable record-keeping of work hours by task is challenging on farms, and adding length to the questions could have reduced the response rate.

Conclusions and Recommendations

Previous studies have noted the need to take exposure into account when studying gender differences in agricultural safety. Our study investigated the gender division of farm work and compensated occupational injuries in the self-employed Finnish farming population. The results indicate that farm work time and injuries differ greatly by gender. Crop production, forestry work, construction work, and several other farm work tasks and corresponding injuries are male-dominated, while animal husbandry and related injuries are divided more evenly between males and females. Males have significantly higher rates of any, minor, serious, and recurrent injuries compared to females.

It can be concluded that gender is an indicator of different work exposures in farming, rather than a risk factor for injury. This study indicates that the risk of injury is nearly equal between male and female farmers, given equal work time. Future studies should examine the gender distribution of work time and occupational injuries more closely in individual farm work tasks.

Increasing knowledge regarding these phenomena may contribute to better understanding of the risk of injury among farmers and farm workers and could help in the design of more effective interventions. We suggest that targeting interventions to males is still appropriate, but it is more important to target the underlying hazardous work tasks and exposures because they increase the injury risk for both males and females.

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