Recurrent Musculoskeletal Conditions among Farmers: A Path towards Disability Pension

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Research indicates that farmers have an elevated risk of musculoskeletal (MS) conditions resulting in disability. This case-control study evaluated the association of compensated occupational MS injuries and diseases and granted chronic MS disability pensions in Finnish farmers. The cases consisted of 1,136 self-employed farmers with a disability pension due to a disease of the MS system and connective tissue granted during a 5-year period (2010–2014). The controls, matched by gender, age, and insurance start year, consisted of 3,408 farmers with neither granted nor rejected disability pension claims of any kind. Disability pension data were augmented with "career-long" workers' compensation claims data for each of the case and control farmers. The cases and controls had a total of 9,040 compensated occupational injuries and 644 diseases. Half of all injury claims and about one-third of occupational disease claims were related to the MS system. The cases had significantly higher incidence of MS injury claims, MS disease claims, recurrent MS injury claims, and serious MS injury claims than the controls. MS claims frequently involved work tasks and causes related to animal husbandry in general and to dairy and beef work in particular. Based on our study, MS injuries and diseases are strongly associated with disability pensions due to a MS diagnosis among farmers. Our results are consistent and add to previous studies which emphasize MS conditions as a major health problem particularly among livestock farmers and workers. We suggest modern working conditions and healthy lifestyle choices could protect farmers from the negative career path leading to permanent loss of work ability.

1. Introduction

Although farmers are a relatively small proportion of the total labor force in many western countries including Finland, agriculture ranks among the most hazardous industries based on occupational injury rates (ILO 2017). In addition to injuries, occupational and other work-related diseases, such as musculoskeletal (MS), respiratory, and skin diseases, constitute a threat to the health of farmers (Donham and Thelin, 2016). Various adverse health outcomes may also cause major changes in production or premature retirement from farming.
A growing body of literature has focused on the characteristics of and risk factors for occupational injuries and diseases in farming (Rautiainen et al. 2009; Karttunen and Rautiainen, 2013; Jadhav et al., 2016). Livestock farmers in general and dairy farmers in particular are at risk of recurrent adverse health outcomes (Karttunen 2014). These outcomes include injuries and diseases of the MS system related to the strenuous working motions and postures in labor-intensive animal husbandry.
Diseases of the MS system and connective tissue are the most common primary reason for disability pension in Finnish farmers in general and female farmers in particular (Karttunen et al., 2015). However, it is not well known how MS conditions develop, and if previous injuries contribute to permanent disability among farmers.
Our study aimed to evaluate the association of compensated occupational MS injuries and diseases and granted chronic MS disability pensions in the Finnish farmers. Using longitudinal national insurance data, we aimed to identify early signs of MS conditions that can lead to permanent loss of work ability.

2. Materials and Methods

This study builds on the earlier study of Karttunen et al. (2015). We used similar administrative insurance data from the Farmers' Social Insurance Institution (Finnish acronym: Mela). These data are used in administration of pension and accident insurance schemes at Mela. No additional data collection was carried out for this study. Mela provided the primary dataset with no personal identifiers in accordance with national laws of confidentiality for insurance data. This procedure was described in a signed agreement between Mela and the authors.

2.1 Study Setting and Subjects

Finnish agriculture is based on privately owned family farms. Self-employed farming population includes farmers, spouses, and salaried family members. According to Mela (2017), self-employed farming population between the age of 18 to 67, from a farm with at least 5 hectares (12.4 acres) of owned or rented farmland, and with at least the defined farm income (≥3,823 Euros in 2017) must take a statutory pension insurance and an accident insurance against occupational injuries and diseases. Smaller farms may obtain these insurances voluntarily. These insurance schemes cover both full-time and part-time farmers.

2.2 Research Data

Disability pension can be granted to secure a farmer's income in case of long-term (at least a year) disability that is not compensated by the accident insurance system. Possibilities for rehabilitation and return to work are first assessed, and acquisition of machinery that eases the work is compensated.

Disability pensions can be full or partial and permanent or temporary. A full disability pension is granted when the permanent loss of work ability, evaluated by a physician and confirmed by the insurance physician, is at least 60%. The required minimum work ability loss for partial disability pension is 40%. Time-limited temporary disability pension is granted due to a threat of disability in the coming few years. Rehabilitation support can include a plan aiming to restore work ability and individual rehabilitation treatments. For brevity, all the above-mentioned disability pension types are from here on referred to as "disability pensions".

Our study design was a case-control study where the cases consisted of 1,136 farmers with a disability pension due to a disease of the MS system and connective tissue granted during a 5-year period (2010–2014). The controls, matched by gender, age, and insurance start year, consisted of 3,408 farmers (1 case: 3 controls) with neither granted nor rejected disability pension claims of any kind. Age and insurance years relate to specific year when the disability pension was granted.

Disability pension data were augmented with "career-long" workers' compensation claims data for each of the case and control farmers. The dataset consisted of demographic variables (gender, age) and the primary and secondary medical reasons (ICD-10 [The International Statistical Classification of Diseases and Related Health Problems, 10th revision] health outcome code) for each compensated and rejected occupational injury and disease claim, and granted disability pension claim.

The ICD-10 code consists of 22 titled chapters (Roman numerals) and their subgroups (blocks) of outcomes (WHO 2017). The results are reported at the block level of the primary medical reason. Examples of outcomes (specific diseases) are listed for several blocks. Secondary medical reasons are presented and discussed briefly (detailed data are not shown).

For each compensated workers' compensation claim, we received the codes for work activity and cause. The work activity code describes the work activity and task of the person during the time of injury or exposure resulting in the occupational disease. The cause code describes the physical object, tool, or other factor in contact with the person at the time of injury or when the occupational disease exposure occurred.

In this study, MS diseases refer to diseases of the MS system and connective tissue (ICD-10 codes: M00–M99) whereas MS injuries include discretionary group of injuries such as joint dislocations, ligament sprains, muscle strains, tendon injuries, and fractures as well as diseases of the MS system and connective tissue compensated as an injury.

2.3 Statistical Methods

The data analysis included frequency distributions of compensated claims and granted disability pensions and descriptive statistics of the age and insurance years of farmers. The differences in mean ages and insurance years between genders were assessed using the t-test. The differences in the relative proportions of the claim types between case and control farmers were compared using the two-tailed chi-square test. Only statistically significant differences were reported ($P < 0.05$). The statistical analyses were conducted using SPSS Statistics Version 22 (IBM Corp., Armonk, NY, USA).

3. Results

The self-employed Finnish farming population with pension insurance declined from 78,558 in 2010 to 67,859 in 2014. Simultaneously, the percentage of male farmers increased from 66.7 to 68.1. The average number of farmers within this 5-year period was 73,235 (males: 49,274, 67.3% and females: 23,961, 32.7%).

3.1 Characteristics and Disability Pensions of the Case Farmers

During 2010–2014, a total of 1,136 Finnish farmers (52.2% male and 47.8% female) were granted a disability pension due to a disease of the MS system and connective tissue; an average annual incidence rate of 0.31 new cases per 100 person-years (males 0.24/100 and females 0.45/100). Females had a significantly higher rate of MS disability pensions compared to males (chi-square test, $P < .01$).

The average age of the cases was 55 years (range 27–63 years), and their average insured career was 26 years (range 1–43 years) at the time when the MS disability pension was granted with no significant differences between male and female farmers (t-test, $P = 0.58$ and $P = 0.93$, respectively).

MS disability pensions of both males and females typically resulted from arthropathies (corresponding ICD-10 codes: M00–M25; 43.9% of all cases) or dorsopathies (M40–M54; 40.3%) (see Figure 1). The most common arthropathies were arthrosis of knee and arthrosis of hip. The most common dorsopathies were other intervertebral disc disorders (i.e., conditions in the spine) and spondylosis (i.e., deterioration in the spine). Shoulder lesions were also common causes of MS disability pensions.

Almost half of the MS disability pensions (48.8%) had a secondary medical reason in addition to the primary one. Most typically both first and second diagnoses were diseases of the MS system and connective tissue.
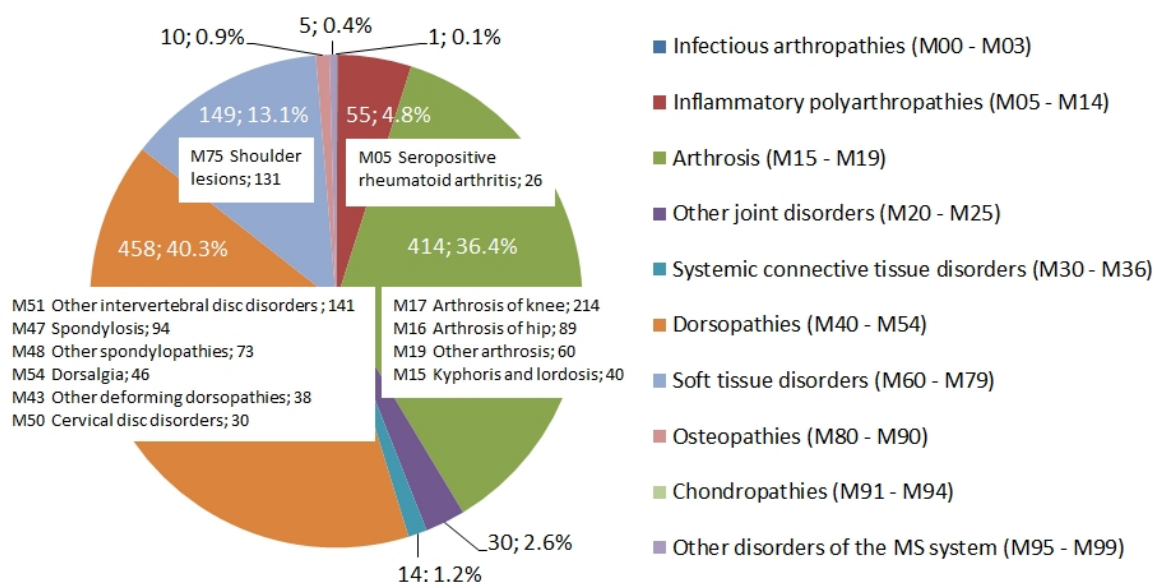

Figure 1: Primary medical reasons (ICD-10 health outcome codes) of the musculoskeletal disability pensions in the Finnish self-employed farming population from 2010 to 2014

3.2 Incidence and Characteristics of Compensated Claims among Case and Control Farmers

The cases and matched controls had a total of 9,040 compensated occupational injuries and 644 diseases in their "career-long" insurance records. On average, cases had 3.5 injuries (range 0–70) and 0.2 diseases (range 0–6) per person whereas controls had 1.5 injuries (range 0–28) and 0.1 diseases (range 0–5) per person.

Table 1 presents the numbers of case and control farmers with various types of outcomes. The cases had significantly higher incidence of occupational injury and disease than the controls (chi-square tests, $P < 0.01$). Consistently, it was significantly less common among the cases than the controls (22.9% vs. 46.2%) to have no compensated claims (chi-square test, $P < 0.01$). However, some of these farmers had rejected claims.

Half of all injury claims (50.0%) and about one-third of disease claims (33.1%) were related to the MS system. The cases had significantly higher incidence of MS injury and disease claims in general and recurrent and serious MS injury claims in particular than the controls (chi-square tests, $P < 0.01$).

Table 1: Incidence of compensated occupational injuries and diseases among case and control farmers

Outcome category	Cases (n=1,136)		Controls (n=3,408)	
	Persons with the specified condition [a]			
	Frequency	Percentage	Frequency	Percentage
Injury	856	75.4	1,757	51.6
Disease	203	17.9	317	9.3
Animal husbandry-related injury [b]	604	53.2	1,006	29.5
Animal husbandry-related disease	134	11.8	191	5.6
Musculoskeletal (MS) injury [c]	677	59.6	1,222	35.9
MS occupational disease [d]	74	6.5	99	2.9
Both MS injury and MS disease	60	5.3	72	2.1
Recurrent (≥ 2) MS injury	428	37.7	548	16.1
Recurrent (≥ 2) MS disease	17	1.5	12	0.4
At least one MS injury, only minor [e]	303	26.7	696	20.4
At least one serious MS injury [e]	374	32.9	526	15.4
Animal husbandry-related MS injury	482	42.4	707	20.7
Animal husbandry-related MS disease	25	2.2	24	0.7

[a] Each of the differences between the relative proportions of case and control farmers are significant (two-tailed chi-square test, $P < 0.01$).
[b] Work activity classification is based on the coding system of Mela.
[c] Includes joint dislocations, ligament sprains, muscle strains, tendon injuries, fractures, and diseases of the MS system and connective tissue compensated as an injury.
[d] Includes diseases of the MS system and connective tissue.
[e] Minor = at most 30 compensated disability days / Serious = at least 31 compensated disability days.

Almost half of all injury claims (4,160; 46.0%) and over half of the disease claims (390; 60.6%) were related to animal husbandry. The rest of the injuries and diseases were distributed between crop production, forestry work, construction work, other farm work, and unknown work activities. Other farm work includes work tasks such as repair and maintenance of machines and equipment, and farmstead and road maintenance.

In animal husbandry, dairy and beef work stood out as the most injury prone sub-group of work activity. Sub-groups of work activity were not available for diseases. The cases had significantly higher incidence of animal husbandry-related injury and disease claims than the controls (chi-square tests, $P < 0.01$).

MS injury claims as well frequently involved work tasks and causes related to animal husbandry in general and to dairy and beef work in particular. The cases had significantly higher incidence of animal husbandry-related MS injury and disease claims than the controls (chi-square tests, $P < 0.01$).

The most MS injury-prone work tasks in dairy and beef work were transporting and moving cattle, milking dairy cows, moving feed for cattle, and feeding cattle. Specific work task codes were not available for diseases.

The most common causes of the animal husbandry-related MS injuries were in descending order: production animals (dairy and beef cattle in particular), sudden working movements or postures, structures (floors, steps, stairs, and ladders), and specific causes related to the outdoor working environment (slippery terrain or ice, and uneven terrain). Continuous, strenuous, or repetitive working movements or postures were the most common causes for the animal husbandry-related MS diseases.

4. Discussion

4.1 Comparison with Previous Studies

In this study, we evaluated the association of compensated occupational MS injuries and diseases and granted chronic MS disability pensions in Finnish farmers based on 5-year insurance records. We aimed to identify early signs of MS conditions that can lead to permanent loss of work ability.

Our study used a case-control design. The well-established national insurance system, administrated by Mela, enabled a unique way to construct the case and control groups. The cases consisted of self-employed farmers with a disability pension due to a disease of the MS system and connective tissue granted during 2010–2014. Threefold number of controls, matched by gender, age, and insurance start year, consisted of farmers with neither granted nor rejected disability pension claims of any kind. Disability pension data were augmented with "career-long" workers' compensation claims data for each of the case and control farmers. Over the 5-year study period, the majority of the MS disability pensions resulted from different types of arthroses or conditions in the spine, and females had higher rate of MS disability pensions compared to

males. In cases where secondary medical reason was given, two MS diseases were most typical combinations of the primary and secondary reasons.

These results are consistent with and add to the previous study of Karttunen et al. (2015), which examined the characteristics and costs of disability pensions in Finnish farmers over a 5-year period. That study stressed the high number of lost working years and high pension costs caused by the MS diseases. Gender distribution of labor-intensive farm work and corresponding exposures, as Karttunen and Rautiainen (2016) suggested, could at least partially explain the higher rate of MS conditions among female farmers.

In our study, the cases had significantly higher incidence of compensated occupational injury and disease than the controls. Half of all injury claims and about one-third of occupational disease claims were related to the MS system. Summing up our results, compensated occupational MS injuries and diseases were significantly associated with granted chronic MS disability pensions in farmers. To our knowledge, there are no earlier studies combining workers' compensation claims data with disability pension data.

While recurrent compensated claims were common among the cases in particular, over one-fifth of the cases and almost half of the controls had no compensated claims of any kind in their "career-long" insurance records.

These results are congruent with the findings of Karttunen and Rautiainen (2013) and Karttunen (2014) who reported clustering of the compensated occupational injuries and diseases especially in livestock farmers based on longitudinal insurance records.

In our study, MS injury and disease claims in general and those of the cases in particular frequently involved work tasks and causes related to animal husbandry. Dairy and beef work and several of its specific work tasks stood out as injury prone activities. These results are in accordance with the previous studies of Osborne et al. (2012); Douphrate et al. (2013); and Karttunen (2014) which emphasize MS conditions as a major health problem particularly among livestock farmers and workers. These studies highlight strenuous and repetitive working motions and postures especially in conventional pipeline and parlor milking. Despite modernization, large-scale livestock farms may not have optimal working conditions. However, based on a recent survey study of Karttunen et al. (2016), automatic milking systems may have significant potential in the prevention of adverse health outcomes in milking of dairy cows.

Results of the current study emphasize the importance of detection and elimination of working conditions leading to injuries and diseases related to the MS system. Recent research has also revealed risk factors related to demographics, lifestyle, genetic predisposition and work setting that should be considered in occupational injury and disease prevention (Ropponen et al., 2013; Kaila-Kangas et al., 2014, Jadhav et al., 2016). Hence, prevention should cover modifiable work and lifestyle-related risk and protective factors, targeting sub-populations at highest risk of occupational injury and disease.

4.2 Strengths and Limitations of the Study

The strengths of this study include availability of a large dataset for a well-defined population, covering granted MS disability pensions over a 5-year period. This data source is a well-established total population-based insurance system. Similar data resources are not typically available for self-employed farmers in the agricultural sector. These longitudinal national insurance data enabled reliable identification of granted chronic MS disability pension claims and matching controls in the self-employed Finnish farming population. The data also enabled identification of all compensated occupational MS injuries and diseases, as well as evaluating the association of MS injuries and diseases and MS disability pensions.

Analyzing only the primary medical reasons for the MS disability pension cases is a limitation of this report. Thorough analysis of the secondary codes as well could contribute to deeper understanding of the complexity of work-related and other medical conditions resulting in disability. However, few results regarding the most common combinations of the primary and secondary codes were presented and discussed.

Our study adds evidence to previous knowledge on MS conditions among farmers based mostly on surveys and workers' compensation data. However, available insurance data included only little information related to the farm production and no information regarding the farmers' lifestyle.

5. Conclusions

Previous studies have indicated that while farmers have a high risk of occupational injuries and diseases, they also have a high risk of chronic MS and other conditions that affect their work ability. Our current study evaluated the association of past compensated occupational MS injuries and diseases and granted MS disability pensions in the self-employed Finnish farming population. We conclude that compensated occupational MS injuries and diseases in general and recurrent and serious MS injuries in particular are strongly associated with granted MS disability pensions among farmers. The injury and disease conditions frequently involve work tasks and causes related to animal husbandry. Simultaneously, many farmers are able

to work for years or decades without any registered occupational injury or disease conditions. These sub-groups of farmers may have specific risk and protective factors. Early detection and prevention of acute MS conditions is critical in avoiding chronic MS conditions and maintaining work ability. We suggest that improvements in the working environment and methods, and healthy lifestyle choices could protect farmers from the negative career path leading to permanent loss of work ability. This information can be used to generate recommendations for the prevention of adverse health outcomes among farmers in Finland and elsewhere.

Acknowledgments

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