

Original Research Article

Farm safety: A prerequisite for sustainable food production in Newfoundland and Labrador

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Abstract

A sustainable approach to food production must address both environmental sustainability and the wellbeing of food producers. Farming is one of the most dangerous occupations globally with high rates of injury, fatality, and occupational disease. However, occupational hazards and the practices that lead to unsafe working environments are often overlooked in sustainable food system research. Poor management of occupational health and safety (OHS) can potentially threaten the survival of individual agricultural operations through injury and illness of the operator, family members, and employees. Gaps in agricultural safety knowledge, prevention, and compensation have been unevenly addressed in Canada. This paper presents findings from the first study of agricultural OHS in Newfoundland and Labrador (NL). Findings from a 2015-2016 survey of 31 food-producing operators representing 34 large and small operations in three NL regions show: 1) that hazards present within these operations are similar to those found in other contexts; 2) accidents are relatively common and most are not reported to workers' compensation; 3) some participating operators were unsure whether their farms are subject to the regulations in the NL OHS Act; and, 4) there are gaps in workers' compensation coverage. Some reliance on local and international volunteers and limited safety training point to other potential vulnerabilities. Study findings highlight the need to incorporate a focused strategy for injury prevention and compensation into efforts to develop a stronger and more sustainable food system in NL. We outline an agenda for future action relevant for NL and other places facing similar gaps and challenges.

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Introduction

Agriculture is considered to be one of the most dangerous types of work in Canada and globally (Canadian Agricultural Injury Reporting, 2016; Donham & Thu, 1995; International Labour Office, 2011). Relative to its substantial direct and indirect impacts on agricultural workers, their families, and their communities, prevention of occupational injuries, diseases, and fatalities in agriculture has received limited public attention and resources (Leigh, McCurdy, & Schenker, 2001), including among critical food studies researchers.

Sustainable agriculture as defined by Hanson (1995, p.591) includes four key aspects: 1) the reduction in chemical use and of excessive cultivation while retaining or enhancing profitability; (2) production of food that will meet the demands of consumer needs; (3) habitat protection as part of agricultural management; and (4) enhancement or protection of agricultural jobs, communities, and the health of agricultural producers. As noted by the Food and Agriculture Organization of the United Nations (FAO) (2014), one of the five principles of sustainable food and agriculture should be to “improve livelihoods and foster inclusive economic growth.” Under this principle, the FAO notes that “agriculture can only become sustainable if it provides decent employment conditions to those who practice it, in an economically and physically safe, and healthy environment” (FAO, 2014, principle 3, p.1). Furthermore, Donham and Thelin (2016) argue that “an extremely significant factor seldom mentioned in sustainability and growth in agricultural productivity is sustaining the health and safety of the people who do the work—the human capital in the agricultural industry” (p. 30).

Both industrial and smaller scale agricultural production have the potential to affect the health of sector operators, employees, and volunteers or interns (Tegtmeier & Duffy, 2004). Weiler, Otero, & Wittman (2016) note that alternative food networks are often based on labour-intensive farming models and these kinds of initiatives “often gloss over oppressive aspects of farm labor by promoting a romanticized agrarian ideology” (p. 1141). Similarly, Shreck, Getz, & Feenstra (2006) found minimal support among certified organic farmers in California for the incorporation of social standards (including protection of the health of workers) into certification processes.

Work-related injuries, illnesses, and fatalities in agriculture have the potential to impose heavy health and financial burdens on operators and their families, and on employees and their families. Family owned businesses are vulnerable when the health of the primary producer is compromised. As indicated by Leigh et al. (2001), “when the farm owner or operator is off work for more than a week, serious economic consequences can ensue. Expenses of the business continue and may even increase” (p. 245). Related concerns about agricultural safety are captured in the catch phrase adopted by the Sustainable Farm Families Project: “There is no point in having a healthy bottom line if you’re not there to enjoy it” (as cited in Brumby, Willder, & Martin, 2009, p. 3). The direct costs of farm injuries and chronic ill health may lead to

bankruptcies, as well as many indirect costs, thereby affecting the well-being of small rural communities and to some degree, of society as a whole (Rathke, 2015; Whelan, Ruane, McNamara, Kinsella, & McNamara, 2009). Poor safety practices can also affect efforts to diversify farm operations through such initiatives as agritourism (Rathke, 2015).

On smaller operations, limited incomes and related challenges around the affordability of and access to safety training, equipment with up-to-date protective features such as roll-over protection on tractors (Day et al., 2009), and limited resources to pay for workers' compensation and other forms of insurance can augment the risk of injury and illness to operators and employees (Gundersen & Offutt, 2005). Health and safety issues are also present on larger agricultural operations such as those in horticulture and dairy, poultry, and hog production (Horrigan, Lawrence, & Walker, 2002). Because of compensation coverage and access to specialized training, larger operations may be more insulated from the social and economic effects of injury, illness, and fatality but they are not necessarily safer places to work. Thus, it is important that initiatives to achieve sustainable food systems incorporate attention to occupational health and safety (OHS) across diverse types of agricultural operations and contexts.

In this study, relevant findings from the first study of OHS on food-producing agricultural operations in the Canadian province of Newfoundland and Labrador (NL) are presented. They are linked with questions related to sustainable food systems and food security. NL has had an agricultural sector since the 19th century. Its agricultural sector is small compared to other Canadian provinces. In 2011, only 0.25 percent of the total number of Canadian farms were located in NL (Statistics Canada, 2011) but growth of the sector is a priority of the NL provincial government which recently almost doubled the amount of crown land available for agricultural development (Government of Newfoundland and Labrador, 2017). Most food produced in NL agriculture is sold within the province. The promotion of the local food production sector is a key aspect of efforts to reduce currently high dependence on costly and insecure supplies of imported food in order to enhance food security and the health of people in NL (Food First, 2017). Thus expansion of the sector is a key element of provincial government plans to diversify the provincial economy. Identifying and addressing threats to the health of operators, their families, and their employees is important to the future sustainability of the NL food system.

Research on OHS on Canadian farms has been concentrated in provinces with large agricultural sectors (such as Saskatchewan) and has focused on a limited range of issues including tractor and other machinery-related hazards, hazards to children, animal and containment-related hazards associated with large, industrial operations and, more recently, occupational health issues associated with increasing reliance on Temporary Foreign Workers (CAIR, 2011). Research, surveillance, and targeted injury and illness prevention programs are limited in other parts of country, including provinces like NL with small, highly dispersed agricultural sectors.

This study of agricultural safety in NL was part of a national research program on agricultural OHS implemented between 2014 and 2017 (Neis, Dabrowska, Butler, & Vincent, 2017). We used a community-engaged approach, seeking input into the design of the study, interpretation of the results, and dissemination of the findings from a multi-stakeholder advisory committee formed specifically for this research. We report here on a sample of food-producing operators' self-reported knowledge and experiences with hazards and injuries, the workers' compensation system, the OHS regulatory system, and operators' experiences with safety training.

The purpose of our study was to address the gap in research on agricultural safety hazards, safety training, regulatory knowledge, and compensation coverage in the agricultural sector in NL—in order to help ensure efforts to rapidly expand and diversify the sector, and to achieve greater food security.

Methods

This research began with a literature review of agricultural safety research contextualized for the province's agricultural sector characteristics (Butler, Neis, & Vincent, 2015). WorkplaceNL¹, the provincial workplace compensation commission, provided a summary of workers' compensation claims data for the agricultural industry between 2008 and 2013. The results of this background research, including an identification of types of hazards and input from our community advisory committee, informed the design of a survey questionnaire with mainly structured and some open-ended questions on operator demographics, numbers and types of employees, commodities produced, hazards, experience with injuries, workers' compensation coverage, and attitudes towards the compensation system, as well as operator awareness of OHS laws that apply to the agricultural sector. Where appropriate, structured questions include an open-ended "other" option. The interview schedule² was pre-tested and further adapted based on results from the pre-test.

Participant recruitment

In order to determine the size, composition, and distribution of the larger population from which to recruit our sample, we first compiled a directory of Newfoundland agricultural operators using information derived from numerous public sources including census information, agricultural industry documents, information from operators, and snowball sampling based on suggestions by participants. A total of 182 food agricultural operations were identified using these means. Some

¹ www.workplacenl.ca

² A copy of the interview schedule can be found at www.mun.ca/safetynet/projects/Interview_Schedule.pdf.

sources have suggested that there are over 500 farms in the province (Statistics Canada, 2011; Department of Natural Resources, 2014). Given how it was developed, the directory was likely skewed towards more commercial operations with a visible presence online and in the industry. A representative of the NL Federation of Agriculture confirmed that their organization has approximately 200 active members (M. C., personal communication, July 14, 2015).

In a bid to ensure the representativeness of the sample, we used a purposive sampling method (Jupp, 2006) by clustering the 182 operations in our directory by region and commodity group and attempting to recruit proportionally from each. The regions included: the Avalon (n=88), Central (n=51), and Western (n=46). The commodity group clusters encompassed meat producing farms (n=25), dairy farms (n=30), vegetable farms (n=30), fruit/berry farms (n=21), horticultural operations (n=40), and honey farms and mixed commodity farms (n=36). Operators within each commodity group were contacted by phone or by email until the predetermined participant quota was reached. As part of its support for the study, the NL Federation of Agriculture emailed a recruitment letter to its membership in Spring 2015. In an effort to increase participation, flyers were also distributed at the annual Conference of the Federation of Agriculture in Winter 2016. We attempted to contact all operators listed at least once.

Our recruitment strategy resulted in a diverse sample that encompassed a broad range of commodity groups and operations of different sizes and included the three main agricultural areas on the Island of Newfoundland. In total, 31 interviews representing 34 distinct agricultural operations were conducted with food producers. Interviews lasted between 40 and 90 minutes.

Survey administration

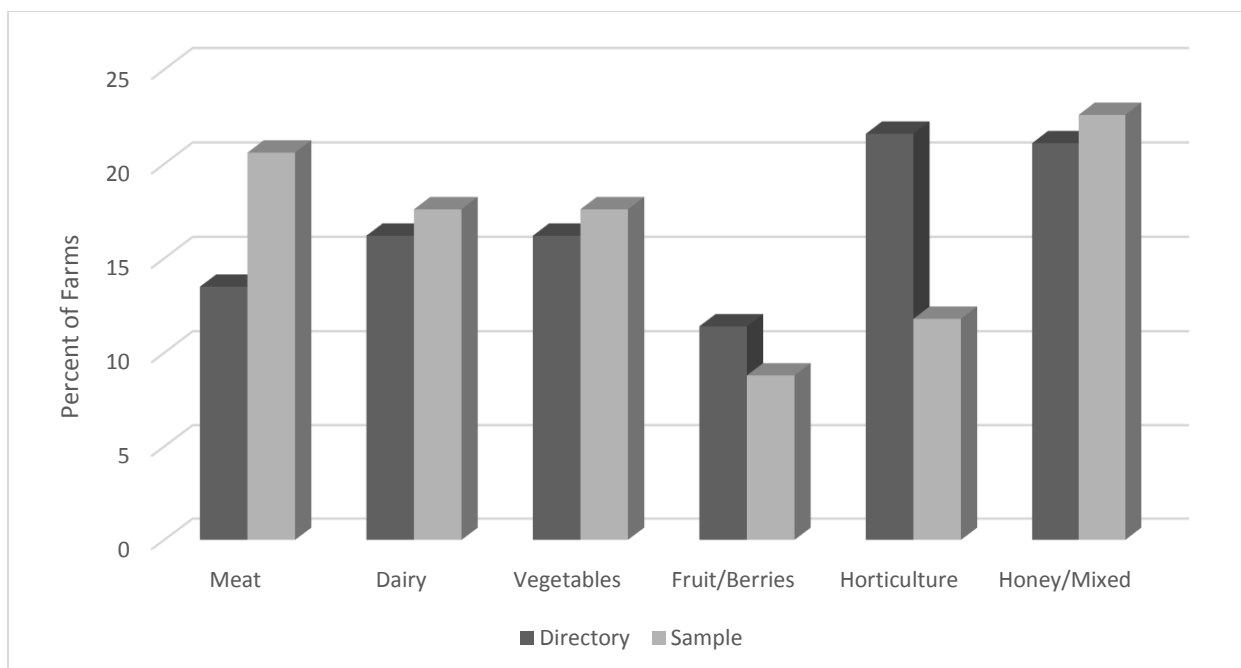
The survey was administered during face-to-face interviews with operators in a place convenient to participants (e.g., on their farms, in their homes, or at a centralized location selected by them). Interviews were not audio-recorded; responses were hand-recorded (written or typed) during the interviews with efforts made to capture close-to-verbatim responses to open-ended questions. Data entry and data analyses were conducted using Statistical Package for the Social Sciences (SPSS v.23). Hand-written responses to open-ended questions from all participants were transcribed and combined with typed responses. All answers were then analyzed using SPSS and Excel software, clustered by question, grouped into themes, reviewed, and used to generate summaries and relevant quotes.

The research design, recruitment strategy, and consent forms for the study were approved by the Interdisciplinary Committee on Ethics in Human Research of Memorial University. Our research results will be presented in five categories: hazards, accidents, injuries, and illnesses; OHS training; knowledge of OHS regulations; workers' compensation coverage; and safety and compensation of volunteers and temporary foreign workers (TFWs) (Butler et al., 2015).

Results

The types of hazards associated with agriculture vary across commodity groups. Figure 1 compares the distribution of commodity groups in our NL directory to the distribution of commodity groups in our study sample. The proportion of dairy, vegetable, fruit/berry, and mixed commodity farms in our sample was relatively similar to their proportion in the industry directory, but horticultural operations were slightly under-represented and meat producers slightly over-represented. It is worth noting that some participants had multiple farms producing more than one type of commodity.

Figure 1: Agricultural commodity group distribution and study sample population (percent).



The mean age of participating operators was 50.1, slightly lower than the mean age of 55.0 for NL farmers in the 2011 census (Statistics Canada, 2011). In 2011, 23.3 percent of NL farmers were women (Statistics Canada, 2011), whereas only five (16.1 percent) of our 31 operators were women. The size of operations in the sample ranged from less than 10 acres to more than 600 acres with a median size of 65 acres. The number of paid employees ranged from zero to 39, with a mean and median of 8.0 and 4.0, respectively. The similarities in many of the means and medians for different commodity groups (Table 1) indicate that for most there was not a lot of variability in the number of paid employees in our sample. The exceptions were dairy, fruit, and horticulture operations, which generally had more employees.

Table 1: Mean and Median Number of Employees, by Commodity Group

Meat	Dairy	Vegetables	Fruit	Horticulture	Honey/Mixed
Mean 4.71	Mean 17.3	Mean 4.0	Mean 13.3	Mean 12.3	Mean 2.9
Median 0.0	Median 14.5	Median 2.0	Median 15.0	Median 3.5	Median 3.0

Ten (32.3 percent) of our 31 participants reported having no paid employees, and five (16.1 percent) reported using volunteers or family and friends to help out. Of those who reported using volunteers three were vegetable/fruit operators. Some indicated that they gave volunteers free produce in return for help during harvest. On average, 39.5 percent of paid employees were full-time, 26.3 percent were part-time but year-round, and 34.2 percent were seasonal. Of the 22 operators with paid employees, 13 (59.1 percent) employed workers primarily from the local area, two (9.1 percent) sourced workers from other parts of the province, and seven (31.8 percent) had employees who came from other locations including from other countries. This latter group includes temporary foreign workers.

Hazards, accidents, injuries, and illnesses

In interviews, operators were asked to select from a list of occupational hazards potentially found on their operation(s). More than 80 percent of respondents indicated the following hazards were present on their operations: bending, lifting, twisting, and/or repetitive motion; slips, trips, and falls; tractors, chainsaws, and other equipment; and noise. Between 70 and 80 percent also indicated the presence of: heat, cold, or wind; power take-off; crushing dust; fatigue; and work-related stress. Chemical exposures, working alone, allergens, ATVs, and animals were selected by more than 50 percent of operators.

For each selected hazard participants were asked, “Has this hazard ever been the source of an accident, injury, or illness on your farm/operation?” Almost 60 percent reported experiencing injuries on their operations (18 of 31) with bending, lifting, twisting, and/or repetitive motion identified as the hazard most likely to be a source of injury (n=11), followed by slips/trips/falls (n=10), and animals (n=6). Types of injuries reported in the interviews included cuts and knocks from chainsaws or other sharp equipment, animal bites/kicks, and instances of being dragged by an animal. Injuries from hazardous weather included hypothermia and frostbite, while eye injuries were associated with chemical and dust exposure. Operators also identified crushed fingers and toes, broken and sprained knees and ankles, heavy lifting injuries, and carpal tunnel syndrome.

OHS Training

One way to help reduce the risk of injury, illness, and fatality is through formal training in health and safety and particularly in agricultural safety. Formal training in agricultural safety was limited among our interviewees and among their employees. When asked, only 16 (51.6 percent) of our interviewees reported having formal agricultural safety training, eleven (35.5 percent) participants reported transferrable safety training from another job or source outside of their agricultural experience, and four (12.9 percent) reported no formal training at all.

Nine (37.5 percent) of 24 agricultural operations employed more than 10 employees and were considered ‘larger operations.’ Under the law, operations with 10 or more employees are required to have joint worker-management health and safety committees. Operations with fewer than 10 employees are required to have health and safety representatives. When asked, “What kinds of training/experience do your employees/volunteers have?” three operators (11.5 percent) said that their employees had training from an on-site OHS committee. Five of the larger industry operators reported having a safety representative on their farm, “to help with injury prevention.” Only eight (36.4 percent) of the 22 operators with employees reported that their employees had at least one of the following: basic first aid, pesticide application, WHIMIS, or CPR. One participant suggested safety should be second nature in that employees should always be properly trained and slowly eased into hazardous work. Another noted, “I don’t have much knowledge, but I always train my employees. It is an even better idea to go to farms and help people to avoid making heartbreaking mistakes.”

Not all employees had general farm experience, another potential source of vulnerability. Only 10 (45.5 percent) of 22 participants with employees reported their employees had some degree of farm experience. Another 10 (45.5 percent) indicated their employees, “get experience as they go.” In these cases, limited safety training was provided by the operator and typically consisted of ‘do’s and don’ts’. Some participants noted that while their employees have little safety training, they limit the tasks and responsibilities around operating dangerous machinery for these employees. For instance, one participant noted that in order to ensure safety, employees were allowed to perform only very rudimentary tasks and were prevented from being, “let loose on whatever they wanted to do.”

Twelve (38.7 percent) of our 31 participants expressed an interest in learning more about training, education, and awareness programs. As indicated above, some have access to health and safety training through work in other sectors and can use this training on their operations. However, this training would not necessarily always be sufficient for injury and illness prevention in agriculture. Under Regulation 5/12 of the *Occupational Health and Safety Act* (Government of Newfoundland and Labrador, 2012), employers are required to carry out risk assessments and have responsibility for their own safety and that of their employees and volunteers. Failure to meet the obligations of *the Act* could result in failed inspections and, potentially, in stop work orders as well as, in the event of an injury or death, prosecution and

finances. This, and the evidence of accidents, injury, and illness among participating operators point to the need to develop a comprehensive and effective health and safety injury prevention program that encompasses training and strategies that work well for small and large operations engaged in diverse activities, dealing with labour turnover, and often located in remote areas.

Knowledge of OHS regulations

Interview participants were asked about their knowledge of the *Occupational Health and Safety Act & Regulations* (Government of Newfoundland and Labrador, 2012), including if they were, “aware of this legislation and the ways in which it applies to you?” Of the 31 participants, only 12 (38.7 percent) said that they were familiar with the legislation. Only those who had experienced a visit from an officer appeared to be aware of the implications of *the Act* for their operations. Nine (29.0 percent) out of 31 participants reported they had received a visit by an OHS officer, four of those were associated with dairy operations.

Eight (25.8 percent) of 31 participants expressed concerns about what they see as a system designed for other kinds of operations being used to regulate their small farms. One participant said he only earns a minimum profit and has a yearly income of about \$20,000 per year. He added that, “government needs to be careful not to introduce safety legislation that will end up rendering a farm unproductive ... safety should not equate to inefficiency.” Five participants indicated that government enforces a ‘one-size-fits-all’ approach to farm safety which may not work in this industry as hazards vary widely depending on the type and size of operations. One operator commented, “They are out of touch with farming. They have one system catering to everyone, but it doesn’t work for everyone. We are trying to follow all the guidelines but this is very hard for us.”

Workers’ compensation coverage

Workers’ compensation is a no-fault insurance system within which coverage provides compensation for lost wages and for medical and other costs in the event of an accident, injury, or illness. It also protects employers from the risk of being sued by an affected worker and thus may be important in terms of limiting risks to the sustainability of food producing operations. Agricultural operators in NL are eligible for workers’ compensation and, if they meet the general registration requirement for employers in the province, are required to register with WorkplaceNL. As indicated by the WorkplaceNL representative on our advisory committee:

According to the *Workplace Health, Safety and Compensation Act* (the Act), c19, s2, “[a]n employer is considered to be any person or entity engaged in business in Newfoundland and Labrador” (Government of Newfoundland and Labrador, 2012; WorkplaceNL, 2016b). This

encompasses sole proprietorships as well as partnerships and corporations. Incorporated agricultural operations must register with WorkplaceNL and coverage is mandatory for all workers, including the owner, director, or managers. Agricultural operations that are non-incorporated, such as some sole proprietorships or partnerships, are not required to register if the only workers are the proprietor or partners. However, if a non-incorporated agricultural operation hires a worker, then they are required to register. Optional personal coverage is available for owners of non-incorporated operations on a voluntary basis. Under the Act, any individual who meets the definition of a worker (family member or not) would be entitled to potential benefits in the event of a workplace injury. However, volunteers are not covered (L. B., personal communication, April 19, 2016).

Interviewees were asked if they had workers’ compensation coverage. The self-reported compensation coverage patterns for the 34 agricultural operations owned by the 31 participants are summarized in Table 2. Of the 24 operations with employees, 20 (83.3 percent) had workers’ compensation coverage for their employees, while four (16.7 percent) did not. All incorporated farms with employees had coverage, and 10 (71.4 percent) of these 14 incorporated farms had coverage for the owner/operator as well. However, owners of both incorporated (3) and non-incorporated (7) operations without employees all indicated they were not paying workers’ compensation premiums and therefore were not covered.

Table 2: Participants’ Self-Reported Compensation Coverage

<i>Operations with Employees (N = 24)</i>		
Coverage for Employees?	Incorporated	Non-Incorporated
Yes	14	6
No	0	4
Coverage for Owner/Operator?	Incorporated	Non-Incorporated
Yes	10	2
No	4	8
<i>Operations without Employees (N = 10)</i>		
Coverage for Owner/Operator?	Incorporated	Non-Incorporated
Yes	0	0
No	3	7

Of the 60 total injuries and illnesses reported in the interviews, only 14 (23.3 percent) had been reported to WorkplaceNL. Registered operators had reported only 50 percent of the accidents they indicated had taken place on their operations.

Interviewees' comments provide some insight into operators' perceptions of, and concerns about, workers' compensation. When asked about the compensation system, one operator stated that workers' compensation, "is there for the workers and for the farmers, so it protects both parties." However, some operators reported concerns about the system. The most commonly reported concerns referenced paying, "premiums disproportionately high for small operations," and, "a lack of support for farmers." Four operators of farms with employees talked about their income level and difficulties paying workers' compensation premiums. Some suggested that the system, "does not [take] the type of farming into account when assessing insurance premiums."

It is difficult to compare premiums across provinces by industry but the average compensation assessment rate for the NL agricultural sector between 2012 and 2016 was \$4.66 per \$100 of payroll (WorkplaceNL, 2016a). Premium rates for individual enterprises could be higher or lower than this amount because of experience-based rating. Depending on the number of employees, wage levels, and seasonality, premium rates could be costly for food producers with relatively low incomes and narrow profit margins.

Safety and compensation of volunteers and temporary foreign workers (TFWs)

While 24 (70.6 percent) of the agricultural operations included in this study had paid employees, most of these employees were family members or came from other families in local areas or regions. Some smaller operations (5) relied on volunteer help from unpaid family and friends and international volunteers recruited through programs like World Wide Opportunities on Organic Farms (WWOOFers). The latter work on farms in exchange for food, accommodation, and experience (WorldWide Opportunities on Organic Farms, 2015). In NL, volunteers are not eligible for workers' compensation. This lack of workers' compensation coverage is an issue of concern for both these volunteers and the operators. To help address the financial threat to the farm of potential risks of injury to farm visitors and volunteers, some of the producers had purchased insurance coverage from private or co-operative farm insurance providers. It is unlikely that volunteers are receiving adequate safety training because, as noted previously, very few agricultural operators offer this training, even to paid employees.

TFWs are common in some parts of the agricultural sector in Canada but they are not common in NL. Of the 15-17,000 workers who came to Canada on approved Labour Market Impact Assessments under the Primary Agriculture Stream in 2016 and 2017, only 13 workers were brought into NL (Statistics Canada, 2017). In the case of TFWs, employers are supposed to provide health insurance and, as paid employees these workers should be covered by workers'

compensation in NL. One of our participants indicated that language barriers can affect the safety of both internationally recruited WWOOFERS and TFWs.

Discussion

The commercial agricultural sector in NL is a small but diverse and dynamic sector of the economy that plays a key role in the local food system. There is strong government interest in expanding the sector beyond current levels of production and the provincial government is encouraging and providing funding for development and diversification (Farm Industry Review Board, 2014).

Our survey findings from a stratified sample of 31 operators representing 34 food-producing operations point to a) diverse hazards and types of injuries; b) uneven and limited awareness of health and safety regulations; c) a lack of adequate safety training, particularly among employees and volunteers; d) gaps in workers' compensation coverage; and e) concerns among some operators about existing compensation and regulatory systems. Based on these findings we conclude that threats to the health of operators, employees, and volunteers need to be addressed to help ensure the sustainability of the NL food system and outline an agenda for future action linking agricultural OHS to food security/sustainable food systems in NL that is potentially relevant for other contexts.

Findings from this study of OHS in NL agriculture suggest that hazards and injuries are diverse, widespread, and similar to those found in agriculture elsewhere. Although operators and their employees fall under provincial OHS legislation in NL (unlike in some other places), awareness of the requirements of the legislation is limited among operators. Similarly, while operators are eligible and, in many cases, required to register with and pay into the workers' compensation system, coverage is incomplete, particularly for the operators themselves. Evidence of substantial under-reporting of work-related injuries and illnesses to workers' compensation, even among operations with compensation coverage, suggest compensation data do not capture the full burden of injury and illness in the sector and that operators, their families and employees, as well as the public health care system, are carrying some of this burden. As noted in interviews reliance on unpaid family, local, and international volunteers is common on some operations, especially smaller ones. Volunteers are not eligible for workers' compensation creating another potential layer of vulnerability for both volunteers and operators.

Study findings also point to substantial gaps in training, particularly among employees and volunteers, and capture some concerns among operators about the regulatory and compensation system and their interest in training. Some operators report compensating for a lack of training of some employees by allocating work that is more hazardous and requires training to those with appropriate training and experience. Investment in appropriate training for operators and employees has the potential not only to improve safety, but also to contribute to the sustainability of operations by allowing employers to make fuller use of their employees.

That said, training takes time and resources and needs to be available and affordable. It can prove costly, particularly in contexts with high labour turnover.

Lack of compensation coverage and, where coverage exists, a failure to report accidents, injuries, and illnesses means that medical and lost time costs are likely borne by the workers, food producers, and their families or by separate insurance coverage, rather than the compensation system. Those without compensation coverage are at risk of being sued by injured and ill workers and volunteers.

Many interviewees are concerned about the hazards in the sector and are interested in learning more about ways to improve safety. However, some feel that the compensation and regulatory systems are not designed to address the sector's diversity and culture, especially relating to experience and training. Operators' concerns that a 'one-size-fits-all' approach to training, regulation, and compensation is unlikely to work well for small operations are supported by the findings of research on OHS in small and medium-sized enterprises from elsewhere (Breslin et al., 2010; Eakin, MacEachen, & Clarke, 2003).

A small number of NL agricultural operators are now using TFWs in order to meet their labour needs. Reliance on TFWs may increase in the future due in part to the aging population and workforce in the province (particularly in rural areas), and due to provincial plans to double the size of the industry. Some smaller operators in particular rely on volunteers – a practice that may also increase. Research conducted in Australia (Underhill & Rimmer, 2016) suggests that volunteers are vulnerable and are often not covered by workers' compensation insurance, as is the case in NL. In the Yukon, which also has a relatively small agricultural sector, legitimate agricultural operations are able to purchase coverage for volunteer workers (Yukon Legislative Counsel Office, 2008). Access to this coverage might help reduce overall insurance costs and the risk of being sued among NL operators who rely on volunteers.

Overall, our findings indicate that small operators, and indeed most operators, are confronting serious challenges related to training, injury prevention, and compensation that may be hard for them to address on their own, at least in the short term. This puts them at risk, poses a threat to efforts to enhance short and long-term food security in the province, and needs to be addressed in programs to expand, diversify, and increase the sustainability of the NL food system. In this context, based on the study results, and drawing on insights contained in Nelson, Lee, Gasperini, & Hair (2012), we developed and shared with the NL Federation of Agriculture, WorkplaceNL, provincial regulators, and others who acted as advisors on our original study, an agenda and key action items that could be used as a guide for future action on OHS in agriculture (see Table 3). The agenda and action priorities focus on the need to invest in coordinated efforts across industry, government, workplace compensation, and research/training institutions to identify best practices for reducing injuries/diseases across large and small operations that take into account commodity types and operation structures of the NL agricultural industry.

Table 3: Agenda and Action Priorities to Guide Efforts to Enhance the Capacity for Injury and Illness Prevention and Compensation among NL Agricultural Food-Producers (modified from Nelson et al., 2012)

Best Practices	Identify the best evidence-based strategies and practices for eliminating and controlling hazards and reducing the risk of injuries/diseases among agricultural operators and employees on small and large operations in NL.
Research and Knowledge-Transfer Priorities	Identify further research and knowledge-transfer priorities for the sector.
Education/Training Needs	Identify the educational/training programs needed to produce an agricultural labour force with the knowledge required to work safely.
Industry Roles	Outline the role of agricultural operators and related sectors and services in promoting agricultural safety.
Public and Organizational Policy	Explore ways to ensure federal/provincial and WorkplaceNL policies and programs meet the needs of owner-operators, workers, and volunteers in the sector.
Farm Organizations	NL has funded safety sector councils with multi-stakeholder involvement for other sectors. Would a safety sector council help to ensure ongoing dialogue and coordinated efforts to improve OHS in agriculture?
Vulnerable Workers	Draw from work done elsewhere to design effective programming for vulnerable workers (including young people, TFWs, volunteers).

Acknowledging that this is the only known study of OHS in agriculture in NL, and that greater resources and experience with agricultural safety research and prevention exist elsewhere, identifying, transferring, and adapting best practices from elsewhere for the NL context is prioritized in the agenda. Gaps in knowledge need to be addressed with further research. There is a clear agricultural safety training deficit on many operations that needs to be addressed both for the current and for future operators, workers, and volunteers. The province currently lacks an agricultural safety association but multi-stakeholder safety associations exist for other sectors in the province to help ensure sustained, coordinated, and systematic attention on improving OHS. The establishment of such an association with representation from the NL Federation of Agriculture, relevant government departments, and WorkplaceNL, as well as worker representatives is an important action item for future discussion.

Conclusion

Research done elsewhere has shown that OHS is an important issue to farmers and their employees because hazards are common in the sector and injury and fatality rates are high (Barnetson, 2010; DeGroot, Isaacs, Pickett, & Brison, 2011; Galizzi & Zagorsky, 2009).

Expansion and diversification of local agricultural production is essential to food security, particularly in remote contexts like NL, and can help support the development of rural economies and more sustainable food systems. Thus, incorporating strategies for the identification and elimination of hazards and for monitoring, treatment, and compensation of injuries and illnesses should be part of sustainable food system planning.

The first of its kind in NL, this study was part of a larger community-engaged research initiative carried out in collaboration with a multi-stakeholder advisory committee that included representatives from key government, industry, and compensation players in the province. Findings point to widespread and diverse hazards similar to those found in agricultural operations elsewhere. They suggest accidents are common and most have not been reported in part because not all operators are registered with the provincial compensation agency. There appear to be serious gaps in safety training related to agricultural safety, particularly among employees.

The study has limitations including, particularly, the relatively small sample of operators surveyed. Issues with the representativeness of that sample mean we cannot generalize across the full population. Another limitation is the reliance on self-report and recall of information on hazards, accidents, and injuries. Small sample size and confidentiality requirements limit our ability to do a finer scaled analysis of variability across types of operations and to explore in-depth complex issues such as the relationship between operation viability, types of production, and health and safety on these diverse operations.

While our findings are indicative of financial vulnerabilities linked to OHS and lack of compensation coverage on many of these operations, we did not ask about farm incomes. Low net incomes, common among farmers in Canada (Qualman, Akram-Lodhi, Desmarais, & Srinivasan, 2018), may be contributing to concerns expressed by some interviewees about the potential consequences of health and safety regulations and compensation costs for the viability of their operations and to the fact that some operators are not covered by workers' compensation. However, survey questions did not address farmer incomes so this would need to be addressed in future research. Some operators indicated that they limit the risk of injury by limiting delegation of certain jobs only to those with training. However, farms are often short of labour, particularly during busy times, and, as shown in research done elsewhere, it is not uncommon in agriculture for employees without adequate training to be assigned to such jobs, in some cases with tragic results (Underhill & Rimmer, 2016). This may happen in NL but can't be confirmed. This is another important area for future research.

NL operators do not currently employ very many TFWs. Existing research on TFWs in Canadian agriculture (Hennebry, 2012; Preibisch & Otero, 2014) has confirmed that language barriers, less safety training and/or education, long work hours, payment by the piece (which can influence work habits), regulatory constraints on their ability to change employers, and related vulnerability to 'black-listing' and deportation if they complain about health and safety or are injured or made ill by their work can contribute to high accident rates among these workers (Frank, McKnight, Kirkhorn, & Gunderson, 2004; Hennebry, 2012; McCurdy & Carroll, 2000).

These issues and the potential vulnerabilities that come with reliance on volunteers identified above should be addressed in the future as part of any plan to expand and diversify the sector.

Based on our findings, we have developed and shared an agenda and list of priority actions to guide efforts to enhance the capacity for injury and illness prevention and compensation among NL agricultural food-producers, along with a set of recommendations (Neis et al., 2017). Taken together, these tools can help position similar regions in the process of expanding and diversifying production to ensure promoting health and safety is a core principle in those initiatives. In NL, there is no targeted initiative for injury and illness prevention for the agricultural sector. Research and development initiatives currently focused on expanding and diversifying the agricultural sector in NL do not have built into them agricultural safety expertise or systematic attention to potential health and safety issues that might arise with the development of new types of production and the introduction of new technologies.

Health initiatives in rural areas often focus on agricultural OHS (Hagel, Pahwa, Dosman, & Pickett, 2013), but this is less common in regions where the sector is relatively small and widely-dispersed as in NL. A food policy for NL and indeed, a Canadian food policy that seeks to achieve sustainable food systems, should include attention to protecting the health and safety of farmers and farmworkers.

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