



Economic worry and the presence of safety hazards on farms

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ARTICLE INFO

Article history:

Received 5 December 2011

Received in revised form 4 January 2013

Accepted 21 January 2013

Keywords:

Agriculture

Farming

Hazards

Injury

Occupational health

Trauma

ABSTRACT

In recent years the agricultural sector has experienced historical levels of economic challenges. Yet, the effects of these economic conditions on the physical safety of farm work environments remain poorly understood. We studied these possible etiological relationships in a cross-sectional analysis. A baseline survey of 2390 Saskatchewan farm operations was conducted in 2007. A single respondent from each farm provided information about the farm operation, its residents, perceptions of worry surrounding farm economic conditions, and the presence of six types of physical hazards. Binomial regression analyses were used to study the focal relationships between economics and safety while simultaneously adjusting for confounders at the farm level. Farms with high perceived levels of economic worry experienced elevations in risk for: the absence of well maintained buildings (RR 1.52; 95% CI: 1.27–1.87), the absence of safety shields on combines (RR 1.41; 95% CI: 1.05–1.89), and the absence of safety shields on augers (RR 1.15; 95% CI: 1.02–1.30). No apparent differences were observed by level of economic worry for the presence of ROPS on tractors, ladder safety cages on grain bins, and barriers around water hazards. We observed that financial conditions on farms appear to contribute to the decisions that farm operators make about safety. These are not innocuous choices as they in turn affect the health and safety of the entire population that works and lives in these occupational environments. Farm operators need to be supported in decisions to invest the physical safety of their farms. They also require evidence that investments in safety are indeed economically sensible and healthy management decisions.

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1. Introduction

While economic conditions on Canadian farms have stabilized since the mid 2000's, 11% of farms are classified as being in a tight financial position with inadequate cash flow and high debt (Financial Situation and Performance of Canadian Farms, 2009, Statistics Canada). Depressed commodity prices in the decade preceding the mid 2000's and escalating production costs have led to reductions in realized net income, higher levels of debt, narrowing operating margins and cash flow shortages. In the 20-year period from 1983 to 2003 the proportion of farm families reporting negative net farming income increased from 33% to 40% among

families operating unincorporated farms (Financial Situation and Performance of Canadian Farms, 2009, Statistics Canada). These economic conditions are likely to influence the health and safety of farm operations.

Rising input costs resulting in narrowing operating margins put constant pressure on farmers to increase their productivity to remain business (Denis, 1988). Even though farmers can control their immediate working conditions, economic pressures to increase their profitability may cause many to "cut corners" on safety expenditures based on a cost/benefit view that does not recognize the costs associated with work-related injury (Kidd et al., 1998; Elkind, 1993; Denis, 1988). A case in point is the presence of rollover protection structures (ROPS) and seat belts on farm tractors. Evidence from Sweden, Norway, Finland and West Germany demonstrated that mandatory ROPS retrofitting and mandatory ROPS on all new tractors virtually eliminated fatal tractor rollover deaths (Springfeldt, 1996). In spite of the overwhelming evidence of the efficacy of ROPS in the prevention of death or serious injury in a tractor rollover event, North American farmers continue to cite the cost of retrofitting tractors with ROPS as one of the main deterrents to installing this safety feature on their tractors (Sorenson et al., 2006). It is reasonable to suggest that this view applies to

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other expenditures directed to improve farm safety conditions such as the retrofitting of guards and shields on other farm machinery and the installation of fall arresting devices on bin ladders. What then is the relationship between poor economic conditions on the farm (at a micro level) and the presence of physical safety hazards on the farm?

To examine this relationship we conducted a cross-sectional study using an existing cohort of Saskatchewan farms (Pickett et al., 2008). *A priori* we expected that farms reporting economic worry would also report the absence of safety features known to increase the potential for major injury (Rautiainen et al., 2010; Pickett et al., 2010). Objective evidence of the existence of these relationships could further understanding of one component of the etiology of farm injuries that operates at the level of the farm work environment, and this in turn could inform prevention strategies.

2. Methods

A cross-sectional survey of 2390 farm operations was conducted as the baseline measurement for the Saskatchewan Farm Injury Cohort Study (Pickett et al., 2008). This study protocol was approved by the Behavioural Research Ethics Board at the University of Saskatchewan. Recruitment was conducted using a modified version of the Dillman *Total Design Method* for Mail and Telephone Surveys (Dillman, 2000). This involved a series of mail contacts with the farms. Data collection commenced in February 2007 and ended in May 2007. A knowledgeable adult from each farm provided information about the farm, including a census of farm residents and workers, descriptors of the farm operation, and indicators of perceived economic conditions and also the presence of a number of types of physical farm hazards. Response rates were high at the level of the rural municipality (50/53; 94%), and reasonable at the level of the individual farm operation (4234/8160; 52%) with 2390 farms (33%) meeting eligibility criteria.

2.1. Perceived economic conditions

The economic condition of the farm was assessed using Likert-like scales that described the frequency of worry on the farm (5 categories: *never* through *daily*) caused by cash flow shortages and debt. These measures were developed on the advice of farm operators who were reluctant to report details about money, farm assets or debt. In order to maximize responses, a surrogate that would reflect the health of the farm finances was used. The surrogate used was worry about indicators of the financial position of the farm. Each indicator proved to be consistent across seasons, so reports from one high-risk season (spring) were used where available and reports from other seasons (summer, then fall, then winter) were substituted in the absence of a spring report. The cash flow and debt measures were combined into an additive score tied to the Likert scale responses (5 categories: daily = 1 through never = 5) for each of the two questions. The additive score had a range of 2 (debt flow and cash flow worry occurred every day) to 10 (debt flow and cash flow worry never occurred). Farms were categorized into three groups using cut points based on the additive scale: (1) high level of worry (2–3); (2) medium level of worry (4–8); and (3) low level of worry (9–10).

2.2. Physical farm safety

We gauged the physical safety condition of the farms based on the most common frequent causes of major farm injury in Saskatchewan and the known effective methods to prevent these injuries. Historically, on Saskatchewan farms machines were associated with 77% of all fatal injuries and 46% of all serious injuries. The machines most often involved in these serious injury events

were tractors (21%), augers (15%) and combines (14%) with entanglements and rollover being the most common mechanisms of injury. In addition falls from heights accounted for (14%) of all serious injuries (Saskatchewan Comprehensive Injury Surveillance Report 1995–2005, 2008). The most frequently cited prevention strategies for these types of injuries are the installation of ROPS on tractors, the presence of protective shields and guards on the exposed moving parts of machinery and the installation of fall arresting devices on high ladders (Springfeldt, 1996; Ingram et al., 2003; Narasimhan et al., 2011; Report 20021A050 FACE 2002). We measured the absence of: (1) rollover protective structures on tractors; (2) well maintained buildings; (3) guards on combines; (4) guards on augers; (5) ladder safety cages on grain bins; (6) physical barriers around water sources on the farms. The farm respondent was asked to report the number of each type of equipment or structure on their farm, and what portion of them were equipped with the relevant safety features. We used a standard scale with four response categories (*all of them, some of them, none of them or not applicable*) in this assessment.

2.3. Analysis

We described the study population by demographic and operational factors. All descriptive analyses were stratified by perceived levels of economic worry (high, medium, low). We then used six separate multiple regression analyses, conducted at the farm level, to examine economic worry as a potential determinant of the absence of the six physical safety features. We used a log-binomial model with the log function to compute adjusted relative risk estimates and associated 95% confidence intervals. The covariates for the final multivariable model were selected based on standard model building strategies as explained by Hosmer and Lemshow (Hosmer and Lemshow, 1989). Analyses were adjusted for clustering at the rural municipality level. *A priori*, we identified potential confounders including: age, education and average number of work hours for the primary owner–operator, number of family members, hired workers on the farm, whether the farm was the primary family residence, management type, primary commodity, and total acreage. The study was 80% powered to detect a relative risk of 1.15 at an alpha level of 0.05, with 2-sided tests of significance assumed.

3. Results

3.1. Descriptive analysis

Table 1 describes characteristics of study cohort stratified by level of economic worry. Farm characteristics that were associated with higher reported levels of economic worry were: primary owner–operator aged 40–69 years, high school level of education of the primary owner–operator, low numbers (1–2) of family members on the farm, hired workers on the farm, individual family farm management, beef production, and larger acreage in production. Factors associated with reduced worry were university education of the primary owner–operator and the presence of older workers on the farm.

3.2. Etiologic analysis

Table 2 presents the results of the binomial regression analysis examining associations between economic worry and the presence of the physical farm safety hazards. After adjustment for potential confounders, farms with higher perceived levels of economic worry reported increased risks for poorly maintained buildings, lack of safety shields on combines, and lack of safety shields on augers. There were no statistically significant differences in the other three

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