JMEE

Journal of Marketing and Emerging Economics

| e-ISSN: 2792-4009 | www.openaccessjournals.eu | Volume: 2 Issue: 5

New Mediation Model of the Agricultural Machinery, Work Environment Factors, and Near Misses on Agricultural Techniques-Related Accidents

Amanov Chori Eshkuvatovich, Abrayev Abdulla Eshboyevich

Senior Teacher of Termez Institute of Agrotechnology and Innovative Development Teachers of the Department of Storage, processing and mechanization of agricultural products

Abstract

Nowadays Agriculture is among the most hazardous productive sectors, and farm machinery is a major source of injury. In the present study, a mediated model was used to test the role played by workers' characteristics, work environment factors, and near misses in predicting agricultural machinery-related accidents in a sample of Italian users (n = 290). Hours worked per week (via the mediation of an adverse work environment) showed a positive association and years of work experience (via the mediation of risk perception) showed a negative association with the probability of being involved in a near miss, which in turn showed a positive association with the probability of being involved in a machinery-related accident. Implications for tailored preventive interventions are discussed.

Keywords: *Agriculture, human factors, near miss, occupational accident, risk perception, mediation model.*

With the mining and construction industries, agriculture is one of the three most hazardous productive sectors both in developing and industrialized countries [1], with an incidence rate of fatal accidents that is double the average of all other industries [2]. Based on data collected by the International Labour Organization (ILO) [3], in the EU-15, the incidence of fatal accidents in agriculture in 2005 was .8 per 10,000 farm workers. The corresponding incidence rate for the mining and construction industries was .5. For the U.S., the National Safety Council [4] reported that the mean fatality rate for the U.S. agricultural industry from 1992 to 2002 was 2.23 deaths per 10,000 farm workers, whereas it was .39 per 10,000 workers for all U.S. industries. Farm machinery is a major source of injury [5], and the highest number of fatalities involves tractors, mainly because of tractor rollover [6]. In the United States, Carlson et al. [7] reported 9.6 tractor-related injuries/1000 persons/year. A similar picture emerges in European Union countries [8] and particularly in Italy, where approximately 2,000 of 31,000 injuries that occurred in the agricultural sector in 2013 involved machinery, and 1,000 were tractor-related injuries [9].

The literature about occupational accidents shows that the occurrence of an accident involves multiple variables related to the individuals and their environment [10]. The same holds true regarding accidents in agriculture [11]. Two different classes of elements have been identified as the main predictors of being a victim of a farm accident: workers' characteristics and work environment factors. In addition to these two classes of risk factors, another powerful predictor of accidents is the so-called near misses, i.e. unplanned events that do not result in any injury, illness or damage only because of a fortunate break in the chain of events [12].

ISSN 2792-4009 (online), Published under Volume: 2 Issue: 5 in May-2022

Workers' characteristics

The main workers' characteristics are socio-demographic variables and those accounting for workers' relation with work [13]. Being an older farmer, working long hours, working alone, and operating on a large farm were found to foster the probability of being involved in farm injuries and fatal tractor overturns [14]. Furthermore, having a low-risk perception has been shown to increase operators' exposure to occupational risks and accidents [15]. However, inconsistent results have been found in the literature with regard to the factors affecting risk perception, in particular relating to work experience and familiarity with tasks, machinery and equipment. In some studies, experience and familiarity were shown to reduce risk perception [16]. According to these studies, this occurs because familiarity may lead to overconfidence in the use of the devices: the lack of accidents in the person's history with the device contributes to the idea that "I could do this with my eyes shut", thus reducing risk perception and the attention rate and increasing the probability of performing an unsafe behavior that may lead to an accident. For instance, a driver's accurate perception of the lateral tilt angle of a vehicle is an important factor in avoiding situations that may potentially lead to a side overturn. Görücü et al. [17], in their study addressing the perception of the lateral tilt angle of agricultural tractors, reported that older and more experienced participants disclosed higher limits of the lateral angle at which they felt uncomfortable and would not have driven the tractor. The result of this perception is depicted by the fatality statistics, which show that older male operators usually represent a large percentage of tractor overturn victims [18]. Other studies, however, noted the opposite result [19]. According to them, individuals in familiar situations might be more likely to perceive the risks because they are more frequently exposed to the risky situation. This may increase compliance with safety practices and reduce the actual risk of accidents. Consistent with this, the results of an investigation of farmers' attitudes toward agricultural tractor innovations showed that the older the tractor users and the longer they had worked in agriculture, the higher their commitment to safe working conditions [20].

Work environment factors

Work environment factors represent the second group of predictors of accidents. They account for workload and work organization [11]. Farm work exposes operators to a high workload due to a combination of different factors. Indeed, farmers usually work longer hours, and mostly alone, than workers in other occupations, and they must perform complex and varied tasks. They also handle different machinery that they must care for and maintain; furthermore, their work may be frequently interrupted by mechanical malfunctions – which occur especially in the case of old machinery – and visitors [13]. These adverse working conditions put high external pressure on farmers, increasing their fatigue and probability of being involved in an accident and being injured [21].

The near misses

Near misses are at the lowest level of the safety pyramid model [22]. They occur more frequently and are smaller in scale than serious accidents, and each major accident is usually preceded by a number of near misses [23]. Near misses have been investigated in different sectors: road and rail traffic [24], plant engineering [25], building safety [26], home safety [27], and health care systems [28]. Less is known in the literature about near misses and their determinants in the agricultural and forestry sector than about other safety issues. Some exceptions are represented by the study by Lilley et al. [29], who showed that accidents among forestry workers in New Zealand were associated with having had near miss injury events, and the literature review on accident prevention by Lundqvist et al. [30], which included studies investigating near misses as a useful source of

ISSN 2792-4009 (online), Published under Volume: 2 Issue: 5 in May-2022

information about farm accidents. However, both the above-mentioned studies considered near misses for their effects (accidents) rather than their determinants. Wright and Schaaf [24] showed that near misses and accidents substantially share the same determinants, confirming the idea that near misses may be considered a proxy of being exposed to the risk of suffering a more serious accident.

Motivations and aims of the present study

Many statistics are available worldwide about accidents in the agricultural sector, their incidence, and the characteristics of the injured workers [1]. Less is known, however, about the processes and the relationships between the critical variables leading to an accident. The two different classes of risk elements identified in the literature (workers' characteristics and work environment factors) and their role in predicting the probability of being involved in an accident have systematically been investigated by analyzing survey data with multiple regression models [11,13]. Such models are undoubtedly fruitful. However, they force the researcher to consider all the predictors considered in the study at the same hierarchical level without taking into account that some variables may simultaneously be predictors of some and outcomes of other variables.

Regarding this aspect, the review of the literature showed that many variables are involved at different levels in the onset of a farm accident. Experience has an influence on risk perception (though previous results are not consistent regarding the direction of such influence: see McLaughlin et al. [16]; Rogers et al. [19]), and risk perception in turn affects the probability of being involved in occupational accidents [15]. In addition, working for longer hours, alone, and on a large farm has been shown to increase workers' exposure to adverse work environment factors [14]. These are conditions that can trigger near misses [31] and accidents [18]. Therefore, we assumed that the processes leading to farm accidents may be more suitably investigated by adopting a mediation model instead of a multiple regression model. In addition, we assumed that the model tested should include the near misses, which have been reported as important predictors of accidents [12] but nonetheless have been under-investigated in previous studies of accidents in agriculture.

Based on these considerations, the present study aimed to investigate the risk factors for agricultural machinery-related accidents in a sample of Italian users, examining the role played by (a) workers' characteristics, (b) work environment factors, and (c) near misses and adopting a mediated model to test the seven different hypotheses (Hs) described hereafter.

Based on Myers and Hendricks [13] and on Hwang et al. [14], we expected working alone (H1), farm size (H2) and working hours (H3) to show a positive association with the exposure to adverse work environment factors. Concerning the relation between years of work experience and risk perception, because of the inconsistent results available in the literature, we made two alternative competing hypotheses. If – as in McLaughlin et al. [16] – work experience leads mainly to overconfidence in the use of devices, it should show a negative association with risk perception (H4a); in contrast, if work experience – as in Rogers et al. [19] – leads mainly to an increased situational awareness, it should show a positive association with risk perception (H4b).

Furthermore, based on Kogler et al. [31] and on Elkind [15], we postulated that exposure to adverse work environment factors would show a positive association (H5) and risk perception would show a negative association (H6) with near misses. Finally, based on Phimister et al. [23], we expected near misses to show a positive association with being involved in an accident (H7). We analyzed such relations via a mediated model rather than a standard regression to account for the complexity of the associations we hypothesized, with accidents being the outcome of the model; working

ISSN 2792-4009 (online), Published under Volume: 2 Issue: 5 in May-2022

alone, farm size, hours worked, and years of experience being the predictors (i.e. the exogenous variables); and adverse work environment, risk perception, and near misses being mediators (i.e. outcomes of working alone, farm size, hours worked, and years of experience and at the same time predictors of accidents).

Go to:

Method

Participants and setting

The study involved a sample of 290 users of agricultural machinery (272 men, Mage = 45.46 years, SD = 17.40). The participants worked an average of 39.67 h per week (SD = 23.72) and had been working in agriculture for 26.45 years (SD = 18.00).1 Participants' distributions of gender, age, education, and occupation were in line with those of the Piedmont and Italian agricultural population, as reported in the VI Agricultural Census of 2010 [32,33]. They were recruited from the visitors to the 35th National Exhibition of Agricultural Mechanization in Savigliano, the largest agricultural machinery exhibition in the Piedmont region (northwestern Italy). The 2016 edition of the show (18–20 March) was attended by over 65,000 visitors. The Piedmont region, one of the 20 Italian regions, covers 35% of the Po River catchment, with agriculture taking place on the plain (41% of the utilized agricultural area – UAA), mainly maize-based systems, and on the hills (31% of the UAA), mainly vineyards and winter cereals [34]. The Piedmont region is a good representation of the Italian farming system and rural population since it includes approximately 10% of the total Italian UAA. Moreover, over 61,000 of the 1,620,884 Italian agricultural holdings operate in this region [32].

Since the agricultural population is spread across the country and has varying operating schedules, agricultural machinery exhibitions are one of the few occasions at which a large and wide-ranging group of agricultural workers comes together. Such events, therefore, provide a suitable location for appropriate surveys and other data-collection activities [17,35].

Instrument

A 27-item self-administered paper-and-pencil questionnaire was used to gather information about participants' work environment, risk perception, near misses, and accidents. The different sections and items of the questionnaire were designed based on previous instruments [11,29] and on the evidence from a preliminary qualitative study [36]. Risky machinery-related tasks and types of accidents and near misses were selected after an analysis of the statistics regarding the most frequent and serious machinery-related accidents and injuries in Italian agriculture [9]. The questionnaire was pilot-tested with a group of eight operators before being submitted to the sample of the present investigation.

The questionnaire was composed of three sections. In the first section, participants were administered a list of four adverse work environment factors: sufficient manpower (con-trait), interruptions by machinery malfunctions, interruptions by on-farm visits, and work delay due to the adoption of safety measures. Participants were asked to rate on a four-point scale (1 = never, 4 = always) how often these four situations occurred on their farm. The three items related to manpower and interruptions came from Glasscock et al. [11], whereas the adoption of safety measures was indicated by farmers as often causing work delays and thus increasing time pressure in agricultural tasks in a preliminary qualitative study [36]. A confirmatory factor analysis (CFA), performed after reversing the first item, showed that the scale was unidimensional, CFI = 1.00, IFI = 1.00, RMSEA = .00 (90% CI = .00, .08).2

ISSN 2792-4009 (online), Published under Volume: 2 Issue: 5 in May-2022

In the second section, participants had to report on a four-point scale (ranging from 1 = not risky at all to 4 = very risky) how risky they considered the following tasks in machinery operations: moving equipment near power lines, manually feeding a wood chipper, using a wood-splitting machine/circular saw, using the tractor on a field without a seatbelt, handling round bales with a front-end loader, working with machinery near ponds or ditches, cleaning a manure spreader while it is in motion, and descending from the tractor without turning the engine off. Items about power lines and working near ponds were taken from Whitman and Field [37], whereas the other items were operations or tasks that are more likely to lead to an accident according to Italian national safety statistics [9]. A CFA showed that the scale was unidimensional, CFI = .93, IFI = .93, RMSEA = .05 (90% CI = .00, .09). Participants' scores on these scales were computed as standardized factorial scores.

In the third section, participants had to indicate how often in the 12 months preceding the survey they had been involved in 5 different types of events involving agricultural machinery, using a 3-category format (0 = never; 1 = once; 2 = twice or more): fall/thrown from a vehicle; run over/crushed by a vehicle; struck by flying objects, broken parts, or hydraulic fluid; side/rear rollover; and road accident with tractor/equipment. Participants were asked to answer the battery twice, reporting for each event how often they had been involved with (i.e. accident) and without (i.e. near miss) suffering an injury. The list of events was created based on the most common types of accidents involving agricultural machinery according to the statistics from the Italian Workers' Compensation Authority [9]. After dichotomizing participants' answers (contrasting the 0 and the other responses), we computed two scores as sums of their responses to the first and to the second version of the batteries that were used as operationalization of the number of accidents and of near misses occurring in the 12 months preceding the survey. A standard socio-demographic form assessing participants' relation with work (hours worked per week, years of experience in the agricultural sector, farm size and whether they were a sole farmer) ended the questionnaire.

Procedure

Trained research assistants handed out the questionnaire to people walking through the exhibition. They approached visitors and asked whether farming was their primary or secondary occupation (i.e. being a part-time farmer) and whether they used agricultural machinery at least once a week. In the case of a positive answer, the assistants explained the aims of the study and informed the participants that the questionnaire was anonymous. The questionnaire was in Italian, and its completion took approximately 6–7 min. No incentive was offered to induce visitors to participate in the survey. The response rate was approximately 85%.

Go to:

Results

Table Table11 reports the descriptive statistics for the variables that the study investigated and the correlations among them. Of the participants, 45.9% had been involved in at least an accident and 44.8% had been involved in at least a near miss in the 12 months preceding the survey.

Discussion

The present study investigated, via a mediation model, the risk factors for machinery-related accidents in the agricultural sector. The model showed that workers' characteristics are associated with exposure to adverse work environment factors and risk perception, which in turn are

ISSN 2792-4009 (online), Published under Volume: 2 Issue: 5 in May-2022

associated with the probability of being involved in near misses and accidents. Consistent with the literature about occupational accidents [10], in the present study, different variables were shown to be interwoven in the occurrence of an agricultural machinery-related accident.

Our mediation model noted the more critical variables and at what level they affect the chain of events leading to accidents, suggesting that machinery-related safety issues be addressed by an ergonomic approach (www.iea.cc) This approach considers the individuals in their interaction with the proper tools and tasks of their work environment and allows interventions to be developed in different dimensions (materials vs. practices) and at different levels (individual level vs. farm level) [38] to find the best fit between the worker and the job in terms of health, safety, comfort, and performance [21].

The results of the study showed that regarding workers' factors, working long hours increased the exposure to accidents through the mediation of adverse working situations, such as interruptions and time pressure. A positive association between hours worked and involvement in accidents has already been noted by previous studies both in the agriculture/forestry sector [29] and in other industries [39]. When an operator works long hours, he/she is likely to address many different situations, which increases fatigue and reduces alertness, causing errors and thus enhancing the possibility of being injured in an accident [40]. Interventions addressing this issue may focus on redesigning the work process [41], for instance, by training workers to take systematic rest breaks during their working hours [38] or assisting farmers in managing external pressures [18].

The worker's experience is another critical workers' factor that, according to the results of the model we tested, enhances risk perception. The outcome of the study contributes to the discussion of the consequences of familiarity with tasks and machinery [16,19], strengthening the assumption of the protective role of this variable. A lack of accidents or near misses in a person's history with a device/machine has been reported to lead to overconfidence in its use and lower risk perception [16]. Similarly, it is reasonable to assume that previous exposure to near misses and accidents is responsible for the positive association between work experience and risk perception found in the present study. In this light, the longer the operator has been working in the field, the more accidents and near misses he/she may have encountered, learning from these events and thus increasing his/her risk awareness and perception [42].

The study showed that higher risk perception predicts lower occurrence of near misses and accidents. Risk perception is thus confirmed to play a crucial role in the occurrence of accidents [15], suggesting further investigation, especially in such a hazardous sector as agriculture. Identifying factors that lead to a higher risk perception in agricultural operators will allow the development of training interventions and information campaigns tailored to maximize their preventive effectiveness.

In the present study, near misses appeared to be a significant predictor of accidents. This result confirms the importance of investigating near misses to prevent more serious accidents [12], including in the agricultural sector, in which near misses have been largely neglected. Farmers may be trained to recognize and annotate near misses to early identify critical aspects leading to accidents and intervene to eliminate or reduce them. According to Kogler et al. [31], the main preventive measures indicated by farmers to help them avoid near misses are, in order of importance, increased training in agricultural operations, mechanical adaptations, and easy-to-understand and short written operating instructions. Regarding the importance of training, the evidence by Burke et al. [43] raises some considerations about the need to adopt not only such conventional training methods as pamphlets, lectures, and videos but also more engaging

ISSN 2792-4009 (online), Published under Volume: 2 Issue: 5 in May-2022

behavioral modeling techniques – such as hands-on demonstrations and behavioral simulations – to promote the correct and safe use of machinery and therefore reduce accidents.

Clear and short operating instructions, such as use and maintenance manuals, and clear and effective safety information about machinery, such as pictorial representations, are additional important elements to promote the safe use of machinery. Operator manuals are supposed to be an exhaustive source of information for the safe use and maintenance of agricultural machinery, but previous studies have shown that they are often unread [44] due to poor document design, requiring a non-negligible cognitive load to decipher pages packed with information that is mainly intended for the legal protection of the manufacturer. Pictorial representations affixed to machinery are visual tools to convey relevant safety information, but they are not as effective as they are supposed to be [45,46]. A re-design of these sources of safety information must be considered to enhance safety in machinery use.

Contrary to the findings of previous studies [13,14] no significant associations between being a sole farmer and farm size on the one hand and exposure to accidents on the other hand emerged. Accidents occur in all types of farms of any dimension and to all kinds of holders: safety interventions and campaigns should, therefore, address all kinds of farms and farm operators without considering some groups more at risk than others.

Limitations of the present study and possible research developments Some limitations of the present study should be acknowledged. The survey was carried out in the Piedmont region of northwestern Italy. On the one hand, the Piedmont farming system is a good representation of Italian agriculture, and performing the study at a local level allowed us to test a parsimonious model: participants in the study had a similar cultural background; thus, we could manage comparable data without controlling for a plethora of socio-demographic variables [47]. Even though the socio-demographic characteristics of our participants were in line with those of the Italian rural population reported in the last agricultural census, it is apparent that only the people who attended the Exhibition of Agricultural Mechanization in Savigliano could participate in our survey. More generalizable results would be available from a random sample of agricultural workers.

Another limitation is that our data on near misses and accidents were based solely on self-reports, and the recall covered quite a long period (12 months). Even though self-reporting is a quite common strategy in this kind of investigation [29,48], and 12 months is the usually considered period [11], it is possible that the participants' responses were affected by memory bias, thus resulting in a gap between self-reported and actual involvement in the reported events [49]. To obtain more accurate information about these variables, a possible direction of study would be to register near misses and accidents weekly (as for the accidents studied in Glasscock et al. [11]).

Finally, it should be noted that the bivariate correlations between our variables were not very strong, like the variance of the dependent variables we have explained. Moreover, consistent with Chaplin [50], the indirect effects that we detected were small. The weakness of these effects may likely be attributed, at least in part, to methodological rather than theoretical reasons. Indeed, as we performed field research, we could measure our variables using short scales; thus, we had to manage measures that were plausibly distorted, at least in part, by measurement error. Stronger indirect effects will likely stem from new research performed using longer scales.

Possible future developments of the research could further explore the relationship between adverse work environment factors and accidents, considering the safety behaviors [11] and coping strategies adopted when dealing with adverse and stressful conditions [51] as mediators of the

ISSN 2792-4009 (online), Published under Volume: 2 Issue: 5 in May-2022

relationship. Moreover, it would be interesting to increase our understanding of the factors contributing to farm accidents in two ways: first, via more objective techniques of data collection, such as the observation of farmers interacting with different machines, to identify risky behaviors that can increase the probability of being involved in an accident (as in Mann et al. [52]), and second, taking directly into account the issue of the age of agricultural machinery, which is known to play a role in the onset of agricultural accidents [53]. The use of aging machines with inadequate safety engineering represents a constant source of risk, as operations involving high numbers of disturbances, e.g. machinery breakdowns, have a higher accident probability [54]; our questionnaire item about frequent interruptions of farm work due to machinery malfunctions was based on this evidence. However, the age of machinery could be explicitly assessed as a factor that could affect the mediators or the outcomes of our model.

Furthermore, the reasons underlying the positive association found in the present study between work experience and risk perception could be further investigated. For instance, a farmer's previous history of near misses and accidents could be evaluated and added as a mediator in the relationship between experience and risk perception, or expert and novice farmers could be observed/interviewed when interacting with machinery to identify the ways in which they perform their complex and varied tasks and the different strategies adopted to reduce risks (as in Mann et al. [52]).

Furthermore, in future research, data collection on farm accidents and near misses could be extended over a longer period. This would allow researchers to investigate the possible mediation effects of previous exposure to such events on the relationship between work experience and risk perception [42]. Finally, a mediation model such as the one used in the present study could be adopted to investigate accidents related to livestock [55] and pesticides [56], which are other major causes of accidents and health issues in the agricultural sector.

Go to:

Conclusions

The chain of events leading to an occupational accident deserves particular attention in agriculture, due to the high hazardousness of this sector. The results of the present study showed that different critical variables intervene at different levels in determining an agricultural machinery-related accident. Hours worked and work experience affected the probability of being involved in an accident through the mediation of adverse work environment and risk perception and then of near misses. These results suggest that different facets of the interaction between the operator and his/her work environment should be considered when designing preventive interventions, ranging from a re-design of the actual work processes to the development of strategies to enhance workers' risk perception. Interventions should also focus on near misses, making the reporting and analysis of these events a widespread and systematic practice among farmers and farm workers [12]. Furthermore, interventions should support the protective role played by work experience by adopting engaging training methods as behavioral modeling in the use of machinery to optimize the learning of safety practices and safe behaviors. Finally, it must be noted that, as found by Kogler et al. [31] with regard to near misses, any solution and intervention aimed at improving the quality of farmers' work life and reducing accidents must also be disseminated to the farming populations in formats that are acceptable and understandable

ISSN 2792-4009 (online), Published under Volume: 2 Issue: 5 in May-2022

References

1. ILO Agriculture; plantations; other rural sectors [Internet]. Geneva: International Labour Organization; 2014; [cited 2016 Sept 02]. Available from: http://www.ilo.org/global/industries-and-sectors/agriculture-plantations-other-rural-sectors/lang–en/index.htm [Google Scholar]
2. ILO Safety and health in agriculture. Geneva: International Labour Office; 2011. [Google Scholar]
3. ILO World day for safety and health at work [Internet]. Geneva: International Labour Organization; 2005; [cited 2016 Sept 02]. Available from: http://www.ilo.org/public/english/protection/safework/index.htm [Google Scholar]
4. NSC Injury facts: 2004 ed. Itasca (IL): National Safety Council; 2004. [Google Scholar]
5. Narasimhan GR, Peng Y, Crowe TG, et al. . Operational safety practices as determinants of machinery-related injury on Saskatchewan farms. Accident Anal Prev. 2010;42:1226–1231.10.1016/j.aap.2010.01.016 [PubMed] [CrossRef] [Google Scholar]
6. Swanton AR, Young TL, Leinenkugel K, et al. . Nonfatal tractor-related injuries presenting to a state trauma system. J Safety Res. 2015;53:97–102.10.1016/j.jsr.2015.03.002 [PubMed] [CrossRef] [Google Scholar]
7. Carlson KF, Gerberich SG, Church TR, et al. . Tractor-related injuries: A population-based study of a five-state region in the Midwest. Am J Ind Med. 2005;47:254–264.10.1002/(ISSN)1097-0274 [PubMed] [CrossRef] [Google Scholar]
8. European Commission Causes and circumstances of accidents at work in the EU. Luxembourg: Office for Official Publications of the European Communities; 2009. [Google Scholar]
9. INAIL Relazione audizione Commissione Agricoltura e Produzione Agroalimentare [Report from the commission on agriculture and food production] Rome: Istituto Nazionale Assicurazione Infortuni sul Lavoro; 2015. [Google Scholar]
10. Reason J. Human error: models and management. Brit Med J. 2000;320:768–770.10.1136/bmj.320.7237.768 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
11. Glasscock DJ, Rasmussen K, Carstensen O, et al. . Psychosocial factors and safety behaviour as predictors of accidental work injuries in farming. Work Stress. 2006;20:173–189.10.1080/02678370600879724 [CrossRef] [Google Scholar]
12. NSC Near miss reporting systems. Itasca (IL): National Safety Council; 2013. [Google Scholar]
13. Myers JR, Hendricks kJ. Agricultural tractor overturn deaths: assessment of trends and risk factors. Am J Ind Med. 2010;53:662–672.10.1002/ajim.v53:7 [PubMed] [CrossRef] [Google Scholar]
14. Hwang S, Gomez MI, Stark AD, et al. . Severe farm injuries among New York farmers. Am J Ind Med. 2001;40:32–41.10.1002/(ISSN)1097-0274 [PubMed] [CrossRef] [Google Scholar]
15. Elkind PD. Perceptions of risk, stressors, and locus of control influence intentions to practice safety behaviors in agriculture. J Agromedicine. 2008;12:7–25.10.1080/10599240801985167 [PubMed] [CrossRef] [Google Scholar]

ISSN 2792-4009 (online), Published under Volume: 2 Issue: 5 in May-2022

16. McLaughlin AC, Fletcher LM, Sprufera JF. The aging farmer: Human factors research needs in agricultural work. Proc Hum Fact Ergon Soc Annu Meet. 2009;53:1230–1234.10.1177/154193120905301814 [CrossRef] [Google Scholar]
17. Görücü S, Cavallo E, Murphy JD. Perceptions of tilt angles of an agricultural tractor. J Agromedicine. 2014;19:5–14. [PubMed] [Google Scholar]
18. Lizer SK, Petrea RE. Health and safety needs of older farmers part II. Agricultural injuries. Workplace Health Saf. 2008;56:9–14. [PubMed] [Google Scholar]
19. Rogers WA, Lamson N, Rousseau GK. Warning research: an integrative perspective. Hum Factors. 2000;42:102–139.10.1518/001872000779656624 [PubMed] [CrossRef] [Google Scholar]
20. Cavallo E, Ferrari E, Bollani L, et al. . Strategic management implications for the adoption of technological innovations in agricultural tractor: the role of scale factors and environmental attitude. Technol Anal Strateg. 2014;26:765–779.10.1080/09537325.2014.890706 [CrossRef] [Google Scholar

ISSN 2792-4009 (online), Published under Volume: 2 Issue: 5 in May-2022