RESEARCHREPORT

PUBLIC HEALTH/WORKER SAFETY

Title: Assessment of Injuries in Pork Production Facilities - **NPB #14-289**

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Date Submitted: July 31, 2017

Industry Summary

Working with pigs has its own inherent risks. The occurrence of injury in people working in agriculture is often higher than most other industries due to the changing nature of the workplace, the unpredictability of the animals, and the wide variety of tasks that have to be done. Injuries not only burden the worker, but can be very costly to the producer. Despite being a known problem in pork production, there is limited information on the most important injuries, the cost of the injuries, and the most efficient methods to prevent them. The objective of this project was to evaluate information about injury occurrence from different producers and establish the needs to more comprehensively evaluate injury burden across the industry. Another objective is to establish working partnerships between NPB, producers, and the University of Minnesota to foster a long-term commitment to reducing the burden of injury in the pork industry. Data from four companies were summarized and the occurrence of injury and accompanying costs were summarized. Specific analyses were conducted to explore the utility of the data for describing and evaluating injuries using three types of injury; animal interactions, knee injuries and needlestick injuries. Of the 3,156 injuries evaluated, about half (1,611) were report only and 566 resulted in work time lost. The total cost for those injuries was over 12.7 million dollars, with a majority of those costs coming from the 566 injuries that resulted in work time lost. Knee injuries in particular were found to be closely related to interactions with animals and tended to be costly. Animal interactions account for over a third (37%) of all animal production employee injuries. In summary, the data used to characterize these injuries varied by company, but creative methods to use worker compensation claims data proved to be quite useful. All injuries can be prevented, but achieving this goal is a significant challenge. Improving how injury

information is collected is important to better evaluate injury risk and approaches to reduce injuries. This is an important goal for the NPB, producers, and the University of Minnesota.

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Keywords: Injury, trauma, worker compensation, pork production, occupational health and safety.

Abstract:

Working with food production animals has inherent risks, however little research has been done to characterize specific injuries in workers who care for these animals. The objectives of this project were to characterize injury burden in swine production workers from swine production company's records and to identify opportunities and limitations of currently used data collection methods. Four commercial large swine production companies were enrolled. Analysis included a summary of claims from injuries receiving only medical treatment, injuries resulting in time-loss, and report only claims for the most common injury sources. The number of medical-only claims for Company 1, 2, 3 and 4 were 441, 27, 101, and, 405 respectively. The number of time-loss claims was 146, 13, 41, and 366, respectively. Time-loss claims resulted in a total reported amount of $10,838,998 in costs. The most common source of time-loss injury was due to animal interactions (49.1%) and the most commonly injured body part was knees (15.2%). Animal handling injury data was re-coded for three companies to characterize misclassifications. Results provide an initial assessment of the most common and costly injuries recorded at swine farms. Identification of the most costly injuries will help employers to better focus their resources when it comes to preventing these injuries.

Introduction

Injury risk is a recognized hazard in agriculture and contact with animals is considered one of the major risk factors (Boyle et al. 1997; Erkal et al. 2008; Hard et al. 2002). Animal confinement operations, including pork, dairy, and beef, are documented to be high injury risk work places in contrast to other areas within agriculture (Kaustell et al. 2007; Mitloehner and Calvo 2008). The limited information specific to pork production suggests similar injury causes compared to other animal operations (Gordon and Rhodes 1993). Researchers' attention has been called to livestock and animal handling, as it has been reported to account for the highest rate of lost workday injuries on the farm, costly injuries, and also be a cause of significant of injuries on the farm (Douphrate et al., 2009; Sprince et al., 2003; Gerberich et al., 1998; Lewis et al., Nordstrom, et al, 1995; Zhou and Roseman, 1994). While a number of these studies have identified broad categories of risk factors, such as contact with animals there are few that clearly identify modifiable factors that can be addressed to prevent injuries. Unlike injury research in other industries, systematic and available surveillance data are largely unavailable for evaluating injury risk in animal agriculture from an epidemiological perspective.

Engagement and collaboration between researchers and industry partners and stakeholders has been illustrated to be an effective means for study of injury issues of high importance wider and more high-impact dissemination, and accelerated implementation of interventions in at-risk populations (Baker, et al., 2015; Boatman, et al., 2015; Macario, et al., 2015; Welch and Baker, 2015; Jaegers, et al., 2013; Chen, et al., 2010; Kreuter and Bernhardt, 2009; Weinstein, et al., 2007;. For example, meaningful and impactful collaborative efforts have been the focus of the CPWR-The Center for Construction Research and Training within the construction industry (Boatman et al., 2015; Chang, et al., 2015; Teran, et al., 2015; Welch, et al., 2015; Macario et al., 2015). The construction industry parallels production animal agriculture with workplaces that have high physical demands, variable and unpredictable environmental conditions, and sizable percentage of immigrant employees in the workplace. As with most animal agriculture the pork industry has evolved from small hold operations to a majority of the pork being produced in larger systems that employ a workforce. A critical difference between industries like construction and agriculture is the lack of systematic characterization of injury risk to help guide occupational health and safety efforts in the industry. Accordingly, progress in preventing and controlling work-related injuries in animal agriculture will require engagement of stakeholders within the industry.

Project Objectives

The long-term objective of this project was to establish a partnership between the Upper Midwest Agricultural Safety and Health Center (UMASH) at University of Minnesota, the National Pork Board, and key US pork industry leaders to comprehensively and routinely assess and evaluate the frequency, causes burden and cost of work related injury and illness in swine production facilities. We anticipate this research program will ultimately facilitate:

- Identifying modifiable risk factors associated with worker injury and illness
- Prioritization of strategies to reduce worker injury and illness
- Evaluate the effectiveness of prevention efforts and document the impact on the industry

To meet these long-term objectives a better understanding of available data and establishing a working partnership is necessary. We propose to work with the NPB and swine production companies to accomplish the following primary objectives.

- Define common terms and definitions for compiling and analyzing workplace safety data
- Assess and summarize available data on the injury and illness burden
- Enhance the utility of available data for injury prevention and control
- Define and assess hazards in pork production
- Determine priorities and concerns of the industry partners and identify potential areas for the National Pork Board, swine production companies and academia to collaborate in research or other programs to reduce the frequency, severity and burden of work-related injuries in the swine industry.

In this analysis we summarize some example data and discuss potential future options for injury prevention research.

Methods

This project was conducted by the Upper Midwest Agricultural Safety and Health Center (UMASH), which has a study area focusing on occupational hazards in the pork production industry. The research team approached ten swine production companies to inquire about interest in participating in the study; eight of these were facilitated by an NPB representative. Participation in the study required the company to share available information about injuries that occurred on the operation and descriptions of the company and the labor force. The injury data was collected from the records kept for reporting to the Bureau of Labor Statistics (OSHA 300 logs), first reports of injury for worker compensation claims, and from worker compensation claims data. Human resource records were evaluated for utility for research purposes. Companies were assured of confidentiality to protect the identity of the worker and the company. Ultimately four companies agreed to participate and provided data. Two additional companies have shown interest in participating but did not provide data in time to be included in this analysis.

Data were reviewed and, to the extent possible, the terminology pertaining to the injuries source and event were re-coded for consistency across all four companies using the Occupational Injury and Illness Classification System (OIICS). Injuries were classified as report only, medical only, or indemnity. Report only injuries were any injury events that did not require mandatory reporting for OSHA purposes, which includes minor injuries that did not require medical care beyond first aid or a reassignment of job duties. Medical only injuries were injuries that were reportable and required medical treatment, but did not reach a threshold of timeloss that triggered worker compensation for lost wages. The Indemnity injuries were injuries that resulted in days away from work. Of note, state laws governing worker compensation determine the threshold for an indemnity claim, thus there can be considerable variability by state.

The data were reviewed to describe injuries and the burden of injuries. To the extent possible the data were grouped into standard categories to classify injuries by body part and cause (source and event) of injury. We summarized the burden of injury in the context of lost workdays, limited duty days, medical care costs, and indemnity costs for lost work time. As the types and causes of injuries in this population are diverse we elected to focus on three common injury categories to evaluate the available data for potential use for injury prevention purposes to better identify areas for specific prevention recommendations. Animal related injuries are the most common cause of injury in pork production. Knee injuries appear to be a common type of injury in pork production workers and can be disabling and costly. Needlestick injuries are frequent, have more clear methods for prevention, and are a current focus of injury prevention programs in UMASH.

To further explore the animal related injuries the data from three of the four companies were more closely evaluated to characterize the potential for misclassification of the cause of injury. The rationale for this approach is that injury prevention may need fairly specific interventions, and identifying the specific injury risks and evaluating prevention efforts requires the cause of injury is clearly defined. In this analysis the injuries initially coded as animal related were evaluated using the text description from the report to determine if the mechanism of injury was directly caused by an animal rather than a secondary cause. The data were recoded using standardized OIICS coding. A sub-analysis evaluated consistency of coding of animal related injuries by two additional coders to characterize how researchers interpreted the data using OIICS.

Results

A summary of the study results is presented for each of the project objectives.

<u>Define common terms and definitions for compiling and analyzing workplace safety data</u>

As expected, there was considerable heterogeneity in the available data from each company. This presented challenges in standardizing the data across companies. Table 1 summarizes the type of data available from each company. While many of the terms are similar, there were appreciable differences in coding. This variability was present not only between companies, but within companies. Many of the records that had similar jobs, injuries, and locations had different terms and spellings for what appeared to be the same category. Records from two of the companies had missing information in a number of categories. This information could sometimes be inferred from the narrative of the injury event and when possible was entered to correct the missing information. An often useful descriptor for injury risk is the job a worker holds. As each company had different classification systems it was challenging to standardize these jobs across companies. Future efforts will address this challenge. While not easy to summarize, the narrative of the injury event is potentially a useful item for conducting an in depth analysis of the data. However, in our experience the narrative was often limited in detail. Having a set of required components of the injury description would give researchers and safety managers an avenue to more fully explore injuries.

Assess and summarize available data on the injury and illness burden from all four companies

A total of 3,156 injuries were reported by the companies, the majority of which, 1,611, were report only with 974 medical only and 566 indemnity claims (Table 2). The burden of injury included 31,981 days of lost work and an additional 44,075 days on light duty (Table 3). These injuries averaged 25.5 and 33 days respectively. While a fewer than half of all reported injuries result in lost time or light duty, the cumulative burden on the companies is appreciable. The average days on light duty or days lost varied considerably between companies, with two large companies having more average timeloss. It should be noted that these companies operated in several states and the individual state regulations can significantly influence the amount of lost time that can accrue. Three of the companies had readily available information on the costs of the injuries. These records include medical payments and indemnity payments or reserves for lost wages and partial or permanent disability. These records are most readily available through worker compensation claims data. The three companies for which data were available accrued over 12.7 million dollars in these costs (Table 4). The indemnity costs are the biggest driver of the total costs and average over 22,000 dollars per indemnity claim. The average costs can be skewed by a few very expensive claims resulting in excessive medical or disability costs, which drove the average costs up for company 1. The average cost for most injuries is approximately 900 dollars in medical costs. In these data the two very large companies were driving the average time lost and costs of injury.

Animal interaction injuries, needlestick injuries and knee injuries represented 37.5, 5.2 and 10.4 percent of the total injuries. Knee injuries accounted for 15.2 percent of all indemnity injuries (Table 5) and 23.5% of the knee injuries were indemnity injuries, whereas needlestick injuries were predominantly medical only claims (58.3%) . The animal interaction injuries and knee injuries resulted, on average, in more days light and days lost when compared with needlestick injuries (Table 3). Hands were the most commonly injured body part, but less frequently resulted in indemnity injury claims than knees, which was the body part associated with the second highest number of indemnity claims (Table 5). Backs had the highest number of indemnity claims. Knee injuries accounted for only 10.4 percent of all injuries, but were the most common body part injured (18.3%) if the injury was caused by an interaction with an animal (Table 6).

Enhance the utility of available data for injury prevention and control

Define and assess hazards in pork production

Exploring the animal injury data identifies strengths and limitations of the routinely collected data for prevention and control of injuries. The available data from all four companies are sufficient to characterize injury occurrence in broad terms. However it is clear that implementation of standardized reporting protocols would help to improve this process. Potential misclassifications of animal related injury comparing the data coded by three of the companies and that. Overall, companies identified 1,148 animal related injuries compared with 946 from the re-coded (Table 7). The overall percent agreement was 82%, but was lower in indeminity claims. The majority of the animal handling injuries from the companies were coded using the terms “animal interaction” or “animal” for cause of injury.

Using the OIICS classification provided more information on the types of AHIs that occurred (Table 8). The majority of AHI's were the result of being "Struck by an animal" (67%) followed by an incident that was "Not Elsewhere Classified" (34%). The cause of an injury as it pertains to source often involves a primary and secondary source. For example a worker struck by a gate that was initially struck by an animal is often, mistakenly, coded as the gate being the source of the injury, leaving the animal out of the analysis. In this case the animal initiated the injury event, and should have been coded as the primary source and the gate, which directly caused the injury, should have been the secondary source. In cases like this, it is important to document both sources that contribute to the injury in order to have a complete understanding of what occurred.

Lastly, OIICS is not set up to capture the task that was being performed at the time of the injury. The most common tasks that were associated with AHI injuries were movement of animals 26% (244/946) and injections/treatments 10% (92/946) (Table 9).

Misclassifications were also identified in the needlestick injuries. Two of the companies were re-coded for comparison. The two companies originally identified a total of 92 needlestick injuries. Re-coding by researchers identified a total of 107 needlestick injuries. These additional 15 injuries were often coded as "sharp objects" and would have been left out of an analysis that was using the term "needle" as the source of an injury. The majority of needlestick injuries were found to be medical claims (80%, 86/107).

In order to evaluate inter-rater reliability in the interpretation of injury descriptions and feasibility of applying a standardized injury coding system, we used independent coders to re-coded the animal-related injuries from one company's dataset. Of the 322 animal related injuries in the original dataset, the study team re-coded using the OIICS protocols to 305 animal related injuries events and 307 injuries related to the animal being the primary source. When coded a second time by an individual who was not previously associated with the study, there was 99 percent agreement in the coding the animal related events and the injuries where the animal was the primary source.

We also use the needlestick injuries as identifiable and as an example of how comprehensive injury prevention approaches can be developed for pork production. The objective is to identify critical points in the injury pathway where prevention and control measures can be implemented. Applying the Haddon Matrix methods will summarize potential determinants of the various injury types by host factors, agents, and social and physical environment in pre-event, event, and post-event categories. The Haddon Matrix approach (Haddon, 1970, Haddon 1972) is a widely accepted method for evaluating injury risks and reducing the harm from injury (Baker and Li, 2012). Our recommendation is to utilize the Haddon Matrix for injuries with a common cause/risk factor or a similar type of injury. As an example of our approach, we describe our recent successful focus on preventing needle stick injuries in animal agriculture (http://umash.umn.edu/resources/product/needlestick-swine-video/?). As noted in previously collected data needlestick injuries are frequent, can result in severe health consequences, and have modifiable risk factors (Buswell, et al. 2015). In human health care there is considerable attention to preventing needlestick injuries due to the risk of transmissible disease. While the disease risks are lower in animal agriculture, the potential for severe, even disabling reactions are possible. Needlestick injuries represent a classic example of a common and potentially severe injury with modifiable risk factors. Identifying the critical points for prevention can aid in developing and fine tuning the prevention measure. An example Haddon Matrix is presented in Table 10. It describes the potential contributors to needlestick injury risk and factors that may lead to additional burden from the injury. The matrix identifies factors that can be considered for prevention purposes and also factors that will limit the damage if a needlestick injury does occur, namely having resources available to respond to the injury and obtaining appropriate care in a timely manner. This approach can be developed for any injuries, but is particularly useful if common causes or prevention modalities can be identified.

Determine priorities and concerns of the industry partners

The primary challenge in using available data for injury prevention purposes is the lack of specificity of the data. Monitoring the occurrence of injury can be accomplished using either BLS reporting data or worker compensation data. An advantage of the worker compensation claims data is that it usually contains more comprehensive information and details costs of injury in addition to occurrence and days away.

We were able to evaluate data from four companies with different approaches to managing injury data. Two of the companies were representative of most small to medium sized companies. The data were collected primarily for regulatory reporting and the systems for retrieving the data were inefficient. The third and fourth companies have taken a very progressive approach to managing injury data. For example, one company's requirement for a successful bid for worker compensation insurance was that the insurance company provide real-time access to the insurance claims data, which can then be linked to other company data, such as safety training, to manage worker safety issues. These data were more comprehensive and consistent due to the link with worker compensation claims. It is notable that these companies also had more comprehensive reporting of 'Report Only' injuries. Reporting of these injuries is not required for OSHA reporting, but can identify 'near miss' situations that may help identify potential problems that would not be recognized by the less frequently reportable injuries. This system has the added advantage of identifying injuries that may become a worker compensation claim in the future and documenting the injury before time distorts the events through fading memories. In a second example, the company showed more consistency in data entry, which was determined to be due to the use of drop down menus and a single employee in charge of reviewing and finalizing all injuries.

A known limitation of using worker compensation claims data or BLS reporting data for research is the absence of information on the workers who do not suffer an injury. We explored the availability of data from the different systems to characterize the population at risk so that specific demographic factors, including age, experience, tenure on the job, and previous injury can be evaluated as risk factors. The available data from the systems was sufficiently complicated such that a comprehensive analysis under this workscope was not possible. However, it is recommended that this be a priority for NPB and industry partners when exploring improved data systems for injury surveillance.

An additional priority is to broadly engage insurance companies in the discussion of injury prevention. Worker compensation insurance carriers may hold additional information on the costs of injury and the care necessary to bring the injured back to work. Workers, employers, and insurance carriers benefit when an injured worker is properly rehabilitated and returned to work. Evaluating the protocols for return to work could be another priority. Worker compensation carriers may also be instrumental in helping deliver safety training and injury prevention strategies. A long-term goal should be to create a program that allows carriers to discount insurance rates if appropriate injury prevention and control procedures are in place.

Finally, the Industry, NPB, and academic partners should be encouraged to explore the indirect costs of injury as well as the direct costs of injury. Employers will more readily invest in prevention efforts if there is evidence that they in fact reduce injury burden and the cost of injuries. A large proportion of injury costs are hidden in the costs of re-training replacement workers and lost productivity.

Discussion
This report summarizes the types of data available from pork production companies that can be used to determine injury prevention priorities. The systems used to capture data vary across companies and terminology may differ. The routine reporting required for regulatory compliance provides a baseline of information, but enhancing those data with information related to worker compensation claims management does a better job at characterizing the burden of injuries. While it was beyond the scope of this project to fully characterize the injury burden in the pork industry or identify viable prevention efforts, we were able to demonstrate how systematic and thorough examination of data can begin to identify specific targets for injury prevention.

Injuries in animal agriculture are a prevalent problem, but a problem that can be controlled. Identifying common, severe, and costly injuries, their causes and methods to prevent them should be a priority of the NPB and pork producers across the country. While all injuries are preventable, identifying the most effective means to prevent them, providing the resources to implement prevention, and evaluating the efficacy of the prevention measures require access to routinely collected injury data of sufficient quality and detail. Understanding the limitations of the routinely collected data will also guide how they can be used for injury prevention. For example, we demonstrated instances of the misclassification of cause of injury, which can result in the underestimation or overestimation of total injury burden from animal related injuries and hamper evaluation of the strategies to prevent animal handling injuries in the future. A uniform application of coding rules, for example the OIICS coding protocols could be implemented to make the data more uniform. As outlined in this report, the current data systems in place are not adequate to evaluate injury across the industry. Companies can enhance the utility of their data by having rigorous injury coding protocols and methods to arbitrate ambiguous injury descriptions. Establishing best practices for injury data collection and management will aid these efforts. Moreover, accounting for classification differences among different data sources will improve surveillance efforts and improve accuracy of injury estimates derived from different data sources (Wuellner and Bonauto, 2014).

Standardized injury coding may improve the overall assessment of the burden of injury for a company and across the industry, but does have limitations in identifying modifiable risk factors for injury prevention. For example, the specific being performed at the time of the injury was important in providing an understanding of the causes of injury. This information is difficult to capture in coding rubrics, such as OIICS (event, source, body part, nature). In our evaluation the movement of pigs was the most common task associated with animal related injuries, but only one company specified the types of movement that were occurring at the time of incident. A specific and/or common task can be added to coding protocols, and also can be captured in a more narrative format where a clear description of the injury event is presented. Reporting criteria around these descriptions will help make these more uniform, e.g. requirements to describe the sequence of events that lead to the injury. We recognize this may be difficult to implement both within and across companies.

As demonstrated in this report, the available data describing injuries that occur in pork production can be successfully used to characterize the burden of injury. These data, however, are limited in being able to fully describe the risk to the individuals doing specific types of work. Future efforts should also include ways to incorporate information from human resource records to identify the number of workers at risk of injury as they do different jobs. Human resource records have been used in many occupational health studies to characterize the population at risk in a specific job or farm, the duration of exposures, and the demographic characteristics of the workers. Availability of these data will allow estimation of specific injury rates, e.g. injury rate in farrowing, gestation, or finishing, and risk by age and experience of the employee. Worker compensation data may have total payroll by risk class (job type), which can be used to estimate the population at risk, but it would not identify demographic information.

Compared to most animal agriculture, pork producers and the NPB are starting to take a pro-active approach to injury prevention. The development of the Employee Safety Tool Kit is a good example of this effort (National Pork Board, 2015). However, the industry will continue to face injury prevention challenges. For example, consumer demand is driving the industry to use more group housing. The potential consequence of this is more workers directly exposed to large animals. Evaluating both the efficacy of programs like the Employee Safety Tool Kit or the UMASH needle stick prevention program, and the emerging threats to the industry requires high quality systematically collected data.

A major goal of this project was to establish a working relationship between UMASH, the NPB, and pork industry leaders. In addition to the ongoing analysis of the current data, the relationships established through this study are being extended to the UMASH renewal. An entire project was proposed to build on the work initiated here and engage worker compensation insurance carriers as well. We believe this will establish a long term partnership dedicated to reducing the burden of injury in the pork industry.

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Table 1. Summary of data available[*] from four companies.

Company 1	Company 2	Company 3	Company 4
Years: *2013 - 2015*	***Years****: 2010- 2015*	***Years****: 2007 - 2015*	***Years*** *2014-2017*
Data source Worker compensation claims system	Data source OSHA 300 record data and supplementary data	Data source OSHA 300 Forms	Data source Workers compensation claims system
Demographics: Age Gender Date of hire Date of loss Day of week Time of loss Year of loss Job title	**Demographics:** Age Gender Date of loss Hours worked Work experience Job title	**Demographics:** Job title	**Demographics:** Gender Job Title Age Length of Service Time of Loss Date of Loss
Farm Information: Area Site Department State	**Farm Information:** Farm Department City State	**Farm Information:** Farm City State	**Farm Information:** Farm Department State
Injury Information: Claim no Task Accident description Initial report Type of claim Status Total incurred Total paid Loss cause group Loss cause detail Loss type group Loss type detail Body part group Body part detail Total days light Total days lost	**Injury Information:** Nature of injury Body part injured Cause of injury Injury source Injury description Medical care Medical payments Indemnity payments Days lost time Days limited activity Time of injury City of injury State of injury	**Injury Information:** Case no Date of injury Injury description Death Days away from work Days work restricted Other recordable cases Location of injury	**Injury Information:** Record no Description Type of Care Incident Classification Case Classification Days Lost Days Restricted Cause of injury Type of incident Nature of Injury Body Part Injured Job Category Claim Type Total Paid

*Names of variables differed across companies.

Table 2. Frequency of injuries for all injuries by company and for selected injury types.

	Type of Claim			
All Injuries	Report Only	Medical	Indemnity	Total
Company 1	936	441	146	1,523
Company 2	9	28	12	49
Company 3	73	101	41	215
Company 4	593	405	366	1,364
Total	1,611	974	566	3,156
Animal Interaction Injuries	581	324	278	1,183
Needlestick Injuries	58	95	10	163
Knee Injuries	174	68	86	328

Table 3. Total and mean, days light duty and days lost work for all injuries by company and for selected injury types.

	Days Light		Days Lost	
All Injuries	Total	Mean	Total	Mean
Company 1	31,023	72	10,638	24.7
Company 2	105	7.5	8	0.6
Company 3	3,806	17.7	896	4.2
Company 4	9,141	11.8	20,439	26.4
Total	44,075	30.7	31,981	22.3
Animal Interaction Injuries	12,848	21.9	18,429	31.5
Needlestick Injuries	765	11.4	763	11.4
Knee Injuries	5,608	39.2	3,319	23.4

Table 4. Total and mean medical and indemnity payments and total costs for all injuries by company and for selected injury types.

	Medical Cost ($)		Indemnity Cost ($)		Total Cost($)	
All Injuries	Total	Mean	Total	Mean	Total	Mean
Company 1	403,993	916	3,048,567	20,881	3,453,477	2,267
Company 2	18,776	695	1,102,932	84,841	1,121,812	22,436
Company 3	NA	NA	NA	NA	NA	NA
Company 4	443,402	1,095	7,659,395	20,927	8,123,976	5,956
Total	866,173	992	11,810,895	22,496	12,698,349	4,323
Animal Interaction Injuries	116,911	1,426	652,030	17,159	768,941	6,629
Needlestick Injuries	32,131	338	90,884	9088	123,015	755
Knee Injuries	61,404	2,274	260,860	15,345	322,265	8,263

Table 5. Distribution of body part injured for reported injuries by claim type.

	Report Only		Medical		Indemnity		Total	
	N	%	N	%	N	%	N	%
Hand	244	15.1	168	17.2	65	11.5	477	15.1
Back	133	8.3	120	12.3	93	16.4	346	11.0
Knee	174	10.8	68	7.0	86	15.2	328	10.4
Arm	163	10.1	91	9.3	63	11.1	317	10.0
Leg	167	10.4	88	9.0	50	8.8	305	9.7
Head	126	7.8	55	5.6	16	2.8	197	6.2
Shoulder	68	4.2	48	4.9	75	13.3	192	6.1
Foot	87	5.4	43	4.4	15	2.7	145	4.6
Multiple Body Parts	58	3.6	38	3.9	20	3.5	116	3.7
Trunk	40	2.5	41	4.2	21	3.7	102	3.2
Missing	8	0.5	22	2.3	8	1.4	42	1.3
Neck	15	0.9	9	0.9	6	1.1	30	1.0
Other	328	20.4	183	19	48	8.5	559	17.7
Total	1611	100	974	100	566	100	3156	100

Table 6. Injuries from animal interactions by body part injured for reported injuries by claim type.

	Report Only		Medical		Indemnity		Total	
	N	%	N	%	N	%	N	%
Knee	107	18.4	46	14.2	63	22.7	216	18.3
Hand	98	16.9	62	19.1	25	9.0	185	15.6
Leg	75	12.9	40	12.3	28	10.1	143	12.1
Arm	55	9.5	34	10.5	36	12.9	125	10.6
Foot	41	7.1	17	5.2	7	2.5	65	5.5
Back	49	8.4	46	14.2	39	14.0	134	11.3
Shoulder	27	4.6	23	7.1	41	14.7	91	7.7
Head	30	5.2	17	5.2	11	4.0	58	4.9
Other	99	17.0	39	12.2	28	10.1	166	14.0
Total	581	100.0	324	100.0	278	100.0	1,183	100.0

Table 7. Reclassification of animal related injuries from three companies: number of injuries reclassified by study team as animal related*

	Report Only	Medical	Indemnity	Total
Original Coding	577	304	267	1148
Study reclassification	514	253	179	946
Percent agreement	89.1	83.2	67.0	82.4

*This table includes data from the three companies that provided coded data. Recoding to animal related so that the animal was the direct cause of the injury

Table 8. Distribution of the types of animal handling injuries as coded by University of Minnesota research team

	Report Only		Medical		Indemnity		Total	
	N	%	N	%	N	%	N	%
Violence by Animals	485	94	233	92	164	92	882	93
Struck by Animal	318	62	125	49	110	61	553	58
Incident N.E.C.	140	27	95	38	49	27	284	30
Bites	25	4.9	13	5.1	5	2.8	43	4.5
Incident Unspecified	2	0.4	0	0.0	0	0	2	0.2
Overexertion/Bodily Reactions	29	5.6	20	7.9	15	8.4	64	6.8
Pushing/Pulling/ Turning	12	2.3	11	4.3	6	3.4	29	3.1
Lifting/Lowering	14	2.7	9	3.6	5	2.8	28	3
Reaching/Stepping/Twisting/Bending/Climbing	1	0.2	0	0.0	2	1.1	3	0.3
Overexertion in holding/carrying/wielding	1	0.2	0	0.0	2	1.1	3	0.3
Overexertion involving outside sources	1	0.2	0	0.0	0	0.0	1	0.1
Total	514		253		179		946	

Table 9. Distribution of tasks during which AHIs occurred

	Report Only		Medical		Indemnity		Total	
	N	%	N	%	N	%	N	%
Moving pigs	**158**	**31**	**53**	**21**	**33**	**18**	**244**	**26**
Unspecified	128	25	41	16	22	12	191	20
Loading/unloading	30	5.8	12	4.7	11	6.1	53	5.6
Injections/Treatments	**43**	**8.4**	**47**	**19**	**2**	**1.1**	**92**	**10**
Unspecified	27	5.3	34	13	1	.6	62	6.6
Treat pigs	7	1.4	5	2	0	0	12	1.3
Treat piglets	3	0.6	7	2.8	1	0.6	11	1.2
Euthanizing pigs	5	1	1	0.4	0	0	6	0.6
Bleed pigs	1	0.2	0	0	0	0	1	0.1
Fixing equipment/cleaning feeders	**17**	**3.3**	**6**	**2.4**	**1**	**0.6**	**24**	**2.5**
Processing	**6**	**1.2**	**14**	**5.5**	**0**	**0**	**20**	**2.1**
Boar Handling	**15**	**2.9**	**1**	**0.4**	**1**	**0.6**	**17**	**1.8**
Ear tagging	**9**	**1.8**	**1**	**0.4**	**1**	**0.6**	**11**	**1.2**
Other	266	52	131	52	141	79	538	57
Total	514		253		179		946	

Table 10. Haddon Matrix Example for Needlestick Injuries

	Person	Agent (needle/syringe)	Physical environment	Social Environment
Pre-event	Training and experience in administration of vaccines/medication to animals and safe needle handling.	Functional equipment. Appropriate materials for job, including needle storage, carriers, and disposal	Design of facility for treating animals. Proper sharps storage and disposal	Workplace safety culture. Adherence to safety protocols. Training availability
Event	Pace of activity, level of concentration, and adherence to best practice technique	Type(s) of needles used.	Position of animal and worker. Excess heat causing stress. Slippery conditions	Co-worker/manager enforcement of protocols
Post-event	Worker reports injury and seeks appropriate care	Information on hazards of biological agents for health care provider	Availability of first-aid equipment and materials	Appropriate treatment. Review of prevention protocols