

Safety and Animal Handling Practices among Women Dairy Operators

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ABSTRACT. *This article presents suggestions toward safer animal handling utilizing the results of a qualitative study of women dairy farmers in Finland. A major proportion of injuries (43%) occur in livestock-related work in Finnish agriculture. An even greater proportion of women's farm injuries (77%) is related to animals. We investigated the working conditions of ten women dairy farmers. Data were collected by observing farm work and performing semi-structured interviews. The study farms represented different milk production technologies with an average farm size of 106 ha (262 acres) of cultivated land, 51 ha (126 acres) of forest, and 45 dairy cows. Farm-related injuries were frequent; eight respondents out of ten had suffered one or several injuries during the previous two years. The women considered farm animals as the greatest hazard, and unexpected animal behavior was viewed as the most significant work-related injury risk. Dangerous situations often resulted from stress in cows caused by unpleasant circumstances or making animals fearful of people. Experiences from some farms suggested that dairy farm work can be relatively safe and that improving the trust between the cows and their handlers plays a key role in safety. We synthesized our findings into four animal handling strategies that can potentially reduce the risk of injury among stockpersons. We developed practical guidelines on how to gradually build a good cow-handler relationship based on our findings and the literature on cattle handling strategies and animal welfare science.*

Keywords. *Agriculture, Dairy farms, Women, Safety, Human-cattle interaction, Injury.*

The number of dairy farms has declined and the average operation size has increased in most western countries. During the first 13 years of European Union membership from 1995 to 2008, the number of farms in Finland declined by 3% per year on average (Niemi, 2009a). The average farm field size and the number of cows per farm increased during past decades by 50% and 97%, respectively (Niemi, 2009b; Väre, 2009; Tike, 2008). The production remained at about the same level, coming from larger farm units with more efficient production methods and modern technologies (Heikkilä and Nurmikko, 2005). Similar changes are expected to con-

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tinue as agriculture worldwide moves toward greater market orientation (Niemi, 2009a).

In spite of structural changes, agriculture in Finland remains based on family farming, as 88% of all farms are owned by individuals or families (Väre, 2009). Family members still perform most (84%) of the work on farms (Joensuu, 2008), and dairy farms in particular are commonly operated by a couple, i.e., the farm entrepreneur and his/her spouse. In 2008, a total of 29,500 women worked on Finnish farms, accounting for 34% of all farm entrepreneurs insured by the mandatory farmers' social insurance system (Farmers' Social Insurance Institution, 2010).

During 2000-2006, 7% of self-employed farm entrepreneurs on average suffered injuries; this rate was 8% among men and 5% among women (Taattola et al., 2007). During 2009, most injuries (43%) within agriculture, fishing, and reindeer herding occurred in raising livestock (Farmers' Social Insurance Institution, 2010). The injury rate among self-employed farm entrepreneurs was more than twice as high (5465 injuries per 100,000 persons) as the rate among all employed workers nationally (2530 per 100,000 persons) (Statistics Finland, 2009). The difference between female farm entrepreneurs and all female employed workers was even greater (3835 and 1343 injuries per 100,000 persons, respectively). These statistics only include compensated injuries (by the mandatory workers' compensation) that result in at least four days of (doctor-assigned) absence from work (Statistics Finland, 2009). The total number of all injuries on farms is unknown, and under-reporting of minor injuries is likely common (Rautiainen et al., 2005a). A survey in 2004 among Swedish farmers ($n = 5646$) indicated that only 8% of all accidents on farms are reported in the official statistics of occupational injuries (Pinzke and Lundqvist, 2007). Based on their research, Pinzke and Lundqvist (2007) conclude that modern techniques and equipment in use today have not considerably decreased the rate of injuries on farms.

Traditionally, women's work tasks on farms have been at home and near home because of their responsibilities related to caring for farm animals, children, and in some cases elderly family members (Sireni, 2002; Karttunen, 2003). However, farm work tasks have become less divided by gender, and the number of farms owned/operated by women has increased. For instance, 306,209 farms out of 2,204,792 in the U.S. in 2007 were owned by women, an increase of 29% in five years (USDA, 2007). Most (77%) injuries among farm women in Finland occur in animal husbandry tasks, while the corresponding percentage among men is only 35% (Eskola et al., 2009). Virtanen et al. (2003) also reported that the majority of women's injuries were related to farm animals. In a 2004 survey ($n = 271$ female respondents), 61% of women reported that the dangers in their work were related to animals, while the proportion among men was 22% (Mäntälä and Louhelainen, 2006). In 1996, men had a higher risk of injury (RR = 1.89; 95% CI: 1.81-1.97) but a lower risk of an occupational disease (RR = 0.68; 95% CI: 0.60-0.78), indicating that occupational diseases are clearly more common among women, and most occupational diseases are caused by animal husbandry exposures (Rautiainen et al., 2005b). On the basis of this information, we chose to focus on women in the present study. We also considered the recent focus of women's health and safety at work as stated by the Commission of the European Communities (CEC, 2007): because women and men often tend to do different types of work "better account must be taken of those aspects of health and safety which specially affect women." This document further states that agriculture is still among the "particularly dangerous" sectors (CEC, 2007). Gender and unpaid family members are also identi-

fied in Strategic Goal 2, vulnerable workers, in the NIOSH National Occupational Research Agenda (NIOSH, 2008). To date, there has been little research focusing on the occupational safety of farm women, although the sector is very hazardous and women are a vulnerable population. Our aim was to examine women's working conditions and hazards on dairy farms using qualitative and action research methods. In this article, we present the main hazards observed, and we propose practical suggestions toward safer animal handling work reflecting our findings and the existing knowledge of animal behavior and animal welfare science.

Materials and Methods

The research material was collected during June and July 2007 from ten Finnish dairy farms. The main parts of the data were obtained by observing the work of farm women and by semi-structured interviews focusing on farm safety and well-being at work. In addition, the research data included notes, photographs, and video recordings. The research material was gathered by one researcher (lead author) with background in research as well as operating an active farm. The study farms were selected based on the following criteria:

- The farm enterprises should represent different types of dairy production technologies, including tie stall, loose housing, and automatic milking systems. The automatic milking system should have been in use for at least a year.
- The farms should be from at least two separate regions of Finland.
- The farm women should represent various ages, work full-time on the farm, and they should be willing to take part in the research project and discuss their work on the farm.
- The interview days should be as normal as possible and during the growing season in order to meet farm women during the intensive work season, which involves the greatest risk of injuries (Tuure, 2005).

Local organizations assisted in finding suitable farms that would fit the criteria. Seven farms were selected by the milk production advisory person of the co-operative Länsi-Maito (Western Milk), and three farms were selected with the help of the Central Union of Agricultural Producers and Forest Owners (MTK). The sample consisted of four dairy farms with a tie stall barn, four with a loose housing barn, and two had barns with an automatic milking system. The farms were located in three regions of southern and western Finland, namely Varsinais-Suomi, Satakunta, and Pirkanmaa.

Farm Visits, Interviews, and Data Processing

The guidelines obtained from the Association for Animal Disease Prevention in Finland were followed when visiting the farms. The purpose of the study and principles regarding voluntary participation, study procedures, and confidentiality were explained to the subjects prior to the study, and they signed a written consent form during the farm visit. Ethics committee approval was not required for this research, but the principles of the Declaration of Helsinki (WMA, 2008) were followed in this research project, in accordance with the laws guiding research ethics conducted by MTT Agrifood Research Finland. The research material has been used confidentially, and reports on the farm women include no information that would enable the respondent or the farm to be identified. Here, pseudonyms are used instead of real names when reporting on the respondents.

A research visit to a farm initially included observation of work in the cattle barn during the morning work period. The visits started between 5:00 a.m. and 1:00 p.m., and the average duration of a farm visit was 5 h 30 min (range 3 h 40 min to 8 h 15 min). The duration depended on the situation on the farm and the amount of work with cattle. After the observations in the barn, a semi-structured interview was carried out. The interviews on farms were organized to reflect the particular circumstances. The woman farm entrepreneur responded to the questions, but in some cases other persons provided some complementary comments. These persons were husbands (for Ann, Linda, and Sara), a daughter (for Linda), and an extension worker for dairy entrepreneurs (for Susan and Sara).

The interview was semi-structured with 32 general questions prepared beforehand and asked of all respondents. The following topics were discussed on every farm: the demographic background of the respondent and farm, distribution of work between family members and workers, health of the respondent, injuries during farm work, use of personal protective equipment, work hazards, mental well-being, work satisfaction, and changes at work during the previous two years. In this article, we report on findings related to the safety and health of dairy cattle handling. The respondents freely provided additional information that they considered important concerning these topics. Altogether, 18 questions were added as the study progressed because the unstructured responses revealed information that appeared important to cover in further interviews. This method for collecting qualitative research material is described by Ely (1991). All interviews were recorded using a microcassette recorder. Partly because of the intensive work season, discussions were interrupted in some cases. All interviews were transcribed word for word. Qualitative notes on the responses of the farm women, such as laughing and whispering, were added to the transcripts to better indicate how the respondent reacted and felt during the interview. During the analyzing process, these notes gave information about the atmosphere during the interviews. The methods for analyzing the qualitative research material included comparisons of findings and the literature, review of findings in light of previous theories, and cross-tabulation of information (Ely, 1991).

Auerbach and Silverstein (2003) describe the process for developing grounded theory using “steps toward understanding.” We used this method and developed the steps and corresponding phases listed in table 1. We also used elements of the action research process (McNiff and Whitehead, 2000) where we summarized the findings from our sample and augmented the existing information from animal welfare science to produce guidelines for safer animal work on farms.

Results

Characteristics of Farms and Respondents

The average size of the farms in the sample was 106 ha (262 acres) of cultivated land, 51 ha (126 acres) of forest, and 45 dairy cows. The farms were larger than average in Finland (table 2). The average age of the respondents was 43 years; eight years less than that among all farm entrepreneurs in Finland (table 2). The women had an average of 19 years of experience in agricultural work. Working on a farm was in nearly all cases (9) associated with marriage to a farmer. Two respondents selected all

Table 1. Application of qualitative research phases in this study (Auerbach and Silverstein, 2003).

| Qualitative Research Phase | Implementation in This Study |
|----------------------------|---|
| 1. Raw text | Research material from the farms: observing women's work, interviews, notes, photographs, and video tapes. |
| 2. Relevant text | Information about injuries and the relationship between cattle and the stockperson. |
| 3. Repeating ideas | Common features of injuries and animals involved in injuries and near misses referenced to statistics of farm injuries. |
| 4. Themes | Differences in: a) Numbers of injuries between respondents b) Relationships between cattle and stockpersons. |
| 5. Theoretical constructs | Combination of: a) Theories of animal welfare science b) References of safe cattle handling practices c) Validation of theories and practices through observations of animal handling methods, injuries, and near misses among study participants. |
| 6. Theoretical narrative | Methods to: a) Gradually improve human-cattle interactions b) Avoid stress in animals resulting in safer animal handling in cattle barn. |
| 7. Research concerns | Guidelines related to animal handling to improve stockpersons' safety based on animal welfare science, existing recommended practices, and observed associations of animal handling methods, injuries, and near misses. |

Table 2. Characteristics of farms and farmers in the study sample and Finland on the average.

| Characteristic | Study Sample | | Finland |
|-------------------------------------|--------------|--------|-------------------|
| | Average | Range | Average |
| Farmers | | | |
| Age (years) | 43 | 34-49 | 51 ^[a] |
| Work experience on the farm (years) | 19 | 7-30 | -- |
| Farms | | | |
| Field (ha) | 106 | 45-200 | 34 ^[a] |
| Forest (ha) | 51 | 12-150 | 52 ^[b] |
| Cows (number) | 45 | 17-75 | 24 ^[c] |

^[a] Väre (2009).

^[b] Tike (2008).

^[c] Niemi (2009b).

of the following reasons for working on a farm: "I have been interested in farm work," "I grew up on a farm," "I married a farmer," and "I decided to take care of my parents' farm." Most of the respondents (6) had professional education in farming gained at an agricultural school (3) or college (3). Four respondents had learned to carry out work tasks through practice.

Injuries

Eight respondents had suffered one or more injuries during the previous two years (table 3). We did not use a specific definition for injury or near miss but allowed respondents to use their own perception. The reported injuries were classified into severity categories according to Sinisalo (2007): seven injuries were slight (sick leave lasting under 4 days and not requiring hospital care), two were harmful (sick leave lasting between 4 and 30 days and requiring hospital care), and one was severe (sick leave of over 30 days and requiring hospital care).

There were differences (not statistically significant) in the numbers of injuries between farms, some having several injuries (such as on Ann's farm) while other farms had been injury-free for years (Linda's and Brenda's farms) (table 3). Different rela-

Table 3. Injuries, near misses, and perceived injury hazards on study farms (cases where animals were involved are indicated in *italics*).

| Respondent Pseudonym, Cattle Barn Type ^[a] | Respondent Injury, Injured Body Part (lost days) | Near Misses to Respondent | Injuries to Other Persons on the Farm, Injured Body Part | Worst Perceived Injury Hazards on the Farm |
|---|--|---|---|---|
| Ann, L | 1. Strained back during lifting. 2. <i>Pushed by cow, hand squeezed.</i> 3. Slipped, back (0). | 1. Slipped. 2. <i>Pushed by cow and calf.</i> 3. Splashed with litter and detergent. | 1. <i>Cow stepped on foot.</i> | 1. Tiredness 2. Machinery |
| Helen, L | 1. <i>Horse pulled on lead rope, injured skin on palm</i> (3). | None | 1. Foot slipped from tractor clutch and pedal injured leg. | 1. Hurry 2. Tiredness |
| Christine, L (AM) | 1. Struck in eye by fence post when pulling fence wire (7). | 1. <i>Pushed by cow while cleaning loose housing barn.</i> 2. <i>Helping cow during calving.</i> | None | 1. <i>Animals</i> 2. Hurry |
| Mary, T | 1. <i>Kicked by cow in forehead when milking</i> (3). | 1. <i>Cow panicked when milking, scared another; respondent was between two jumping cows.</i> | 1. Strained back when lifting. 2. Fell from truck during hay harvesting, wound to head. | 1. <i>Animals</i> 2. Tiredness |
| Nora, L | 1. Slipped on icy ground, head (3). | 1. <i>Kicked by cow.</i> 2. <i>Slipped on milking parlor steps.</i> | 1. Slipped; ladder fell during construction work, foot. | 1. <i>Animals</i> 2. Machinery |
| Brenda, L | None (0) | 1. Roadway; driving tractor to field, front end loader forks dropped and trailer tumbled. 2. Avoided hitting a bus that was sliding sideways on a narrow road. | None | 1. Hurry 2. Tiredness |
| Susan, T | 1. Skin burned from silage preservative acid; leaky container lid, stomach (7). | 1. Roadway; avoided collision with a scooter, vision obstructed by tractor cabin post. | 1. <i>Kicked by cow, no information about the injured body part.</i> 2. <i>Pushed by bull, shoulder injured.</i> | 1. <i>Animals</i> 2. Hurry 3. Tiredness |
| Linda, T | None (0) | None | None | 1. <i>Animals</i> 2. Hurry |
| Sara, L (AM) | 1. Slipped on icy ground, head (87). | None | 1. <i>Pushed by heifer, broke sternum.</i> | 1. Machinery 2. <i>Animals</i> |
| Ellen, T | 1. <i>Kicked by cow when milking, hand</i> (0). | 1. Slipped. 2. <i>Near miss when transporting animals.</i> | 1. Deep wound when repairing farm machinery, hand. | 1. Hurry 2. <i>Animals</i> |

^[a] L = loose housing cattle barn, L (AM) = loose housing cattle barn with automatic milking system, and T = tie stall cattle barn.

tionships between cattle and handlers were observed, and they may contribute to the apparent differences among dairy farms in their injury experience. Animals were involved in four of the ten reported injuries (table 3). In addition, animals were involved in seven of the 13 reported near misses. Animals were also involved in four injuries to other persons (than the respondent) on the farm (9 cases total). Seven out of ten respondents viewed animals among the greatest injury hazards (table 3). Unexpected

animal behavior was mentioned most often as the primary source of work-related harm during the interviews.

Different Relationships between Cattle and Stockpersons

When synthesizing the information from farm visits, presented in table 4, the following four strategies in animal handling and relationships between animals and stockpersons were identified. Note that one woman used one or several of these strategies.

1. Planning the work holistically by considering animal welfare and work safety

Several investments and improvements had been carried out in order to simultaneously improve animal welfare and occupational safety. On Nora's farm, this included purchasing new thicker mattresses for the cow stalls and increasing the amount of bedding material to make the cows more comfortable during rest and sleep. The drinking water for the cows was warmed, and the water cups for the bulls were reorganized so that cleaning was possible from outside the pen. In addition, it was possible to monitor the situation in the barn, e.g., if a cow was about to calve, via a TV in the kitchen. The stockperson talked to the cows calmly during milking and greeted each cow by name. [Nora, total number of cattle 70]

2. Understanding animal behavior: good interaction with the animals, avoiding hurry and actions that cause fear of people in animals

Christine never shouts at the animals. She patiently waits while a cow moves, which takes a certain time. There is no need for hurry. If she has to guide a cow to a certain place, she uses a plastic manure scraper to guide and touch; she gently knocks the cow on the flanks and calmly talks to it all the time. She describes: "You should never make a cow be afraid of people. I feel that I am one member of this herd in the barn. If the calving is near, I follow the cow's gestures if it asks for help from me." [Christine, total number of cattle 203]

Guidelines are given to visitors beforehand on how to behave in the cattle barn: shouting, running, or sudden movements are forbidden. The animals should not be afraid of people. When the researcher wondered how it was possible to work among animals for 20 years without injuries, the explanation was simple: "The animal does not harm its own stockperson in any way." [Linda, total number of cattle 29]

The cows become used to certain handling methods and routines. Susan described how those persons who work in the cattle barn during the entrepreneur's holidays should have the same working style as the regular stockperson. If the method of handling is very different, the animals may react, and the quality or quantity of milk produced may also change. [Susan, total number of cattle 85]

A positive interaction with animals (Helen, Brenda) is described in table 4; handling animals is considered a challenge. [Helen, total number of cattle 77; Brenda, total number of cattle 136]

3. Being careful and prepared to protect oneself from the animals

There are certain periods when a cow's behavior may be unusual. Just after calving, a dam may defend her offspring and the behavior of the dam may be dangerous for the stockperson. During the estrus period, a cow's behavior may be unexpected and the animal may start to follow the stockperson and try to mount her or him. In addition, moving to the pasture in the spring may be a difficult and potentially dangerous if the

animal is scared of the sudden change in environment, bright lights, and noises outside the cattle barn. [Christine, total number of cattle 203; Ellen, 118; Sara, 200]

“One cow in the herd may be very sociable, friendly, and ‘ask’ to be scratched. But you must also be careful, as sometimes this animal may become aggressive, especially if you don’t have time to communicate with it.” The stockperson had a manure scraper with her all the time for self-defense when moving among the cows. [Ann, total number of cattle 53]

4. Avoiding control of animals by force and avoiding unpleasant conditions for animals in the barn

In some cases, we observed situations where the stockperson made the animals afraid of her or him and controlled them by using force. As an example, the handler attempted to force a just-calved cow to stand motionless in a tie stall during the first milking by twisting its tail. During the interview, Mary said that this kind of animal handling by force had been used sometimes in past years when Mary’s parents in law ran the farm. The conditions in this barn were unpleasant for the cattle. In one instance, the noise from a radio was so loud that the couple had to shout to communicate with each other in the barn. Based on interviews and observations, these conditions affect the behavior of animals, in some cases resulting in incidents where a cow simply rushed in panic and behaved unexpectedly, putting the stockperson in danger. Use of force may be necessary in cases of self-defense, as discussed above in strategy 3. [Mary, total number of cattle 107; Ann, 53].

Discussion

This study involved a case series of ten dairy farms in Finland. The farms were larger than average. The larger size is likely a result of the sampling process, as most farms (6) in this study had loose housing dairy barns (four conventional milking and two automatic milking systems) where the herd size is usually larger than in tie stall barns.

The proportion of farm women experiencing injuries was very high; eight out of ten had one or more injuries during the past two years. According to 2007 statistics for Finland, women farm entrepreneurs have nearly three times more injuries (3.8 injuries per 100 workers) than employed women in general (1.3 injuries per 100 workers). Injuries are clearly more frequent among male farm entrepreneurs (6.3 injuries per 100 workers) compared to women. Within the European Union, the accident rate in agriculture is 30% higher than the average rate in all occupations (CEC, 2002). Typically less than 10% of farmers report injuries annually (McCurdy and Carroll, 2000; Rautiainen and Reynolds, 2002; Hard et al., 2002). The difference in women’s and men’s injury rates may in part be explained by the traditional distribution of work tasks on farms; women’s work often includes more domestic work, while men’s work includes more field, forestry, building maintenance and machinery work (Sireni, 2002; Karttunen, 2003). In addition, it has been reported that farm women are more “concerned with safety behaviors” and health issues than farm men (Cole et al., 2000; Davidson and Freudenburg, 1996; Dewar, 1996).

The injuries were distributed unevenly; some women had no injuries, and some had up to three. The finding that some farmers or stockpersons are susceptible to more

Table 4. Respondents' farm work experience, number of cows and young cattle per farm, and relationship between cattle and stockperson.

| Respondent, Selected Feature, Years of Farm Work Experience, (and No. of Cows/Young Cattle) | Relationship between Cattle and Stockperson ^[a] |
|---|---|
| Ann, several injuries, 28 years (28 / 25) | <p>+Ann considered that the stockperson should know the different characteristics of animals (i), one should always have something in hand to use for self-defense (o).</p> <p>-Several dangerous situations and injuries with animals, e.g., bovines acted unexpectedly or rushed in panic, and she got rammed between barn structures and bovine (i, o).</p> <p>-Because of the economical situation and her son's lack of interest in cows, barn was not equipped with manure scrapers and Ann worked several hours cleaning in cattle barn among animals (o, i).</p> <p>- Ann reported tiredness; she had no possibility for proper rest (i). Negative elements like economical problems, diseases, tiredness, injuries, and cynical attitudes seemed to dominate on the farm (i, o).</p> |
| Brenda, no injuries, no sick leave, 23 years (71 / 65) | <p>+Brenda considered that taking care of bovines is rewarding; she was interested in learning new skills with the veterinarian (i); she had a calm working style (o).</p> <p>+ She had created a social network to manage the increased work tasks (o, i).</p> <p>+She had no injuries and no sick leave during the past year but had two near misses in traffic (not in the cattle barn); the previous sick leave was 15 years ago (i).</p> <p>-A special danger in work for Brenda was giving injections to bovines (o, i).</p> <p>-Brenda lacked needed workers in the cattle barn and talked about coping (o, i).</p> |
| Christine, skillful animal handler, 18 years (63 / 140) | <p>+Christine emphasized the need for the stockperson to simply observe cattle (o).</p> <p>+She felt herself a member of the herd and observed cows: "Is she asking help from me?" (o).</p> <p>+She never shouted in the cattle barn; she talked calmly to the animal when guiding a bovine (o).</p> <p>-Experiences with dangerous situations after calving, during estrus, and when bovines go to pasture (i).</p> |
| Ellen, difficulties in well-being at work, 23 years (58 / 60) | <p>+Ellen considered that one should never "show" hurry to a bovine; it may cause dangerous situations, e.g., during animal transfers (o, i).</p> <p>-She considered that pushes and kicks of bovines are among the worst harms; the worst injury source is hurry, followed by animals. Reported several injuries (i).</p> <p>-A difficult life experience: how to run a dairy farm alone during her husband's serious illness (i).</p> |
| Helen, motivated and inspired, 22 years (37 / 40) | <p>+Helen regarded animal handling as a challenge, part of interesting work (o).</p> <p>+She enjoyed working in the cattle barn together with her husband: "in a way we are one." She had a special method to separate a cow in a loose housing barn with her husband (i, o).</p> <p>-Her husband had a burn-out sick leave, and Helen was worried how to manage with cattle if her husband suddenly became ill (i).</p> |

^[a] + = positive, - = negative, i = information from interview, and o = information from observation.

injuries than others has been observed in other studies (Rautiainen et al., 2004; Karttunen, 2007). While many risk factors for injury among farmers have been identified (Virtanen et al., 2003; Rautiainen et al., 2009), the reasons for the uneven distribution of injuries is largely unknown.

Table 4 (continued). Respondents' farm work experience, number of cows and young cattle per farm, and relationship between cattle and stockperson.

| Respondent, Selected Feature, Years of Farm Work Experience, (and No. of Cows/Young Cattle) | Relationship between Cattle and Stockperson ^[a] |
|--|---|
| Linda, no injuries for past 20 years, focused working in cattle barn, 23 years (17 / 12) | +Linda had worked safely with animals for a long time; her last injury with a field machine was 20 years ago (i). +Bovines go out daily also during winter time (i), daily animal transfers without any injuries (o). +She had special guidelines for cattle barn visitors on how to behave in order to avoid bovine's fear (i). -She had observed a danger for a milker: if a bovine is transferred to new place in the cattle barn, the stockperson may have to milk between two quarrelling cows (i). |
| Mary, several injuries, 9 years (40 / 67) | -Mary told about several injuries and near misses related to unexpected behavior of bovines (i). -There was heavy noise (radio on) in the cattle barn, and a cow was made immobile by force; the situation was perhaps painful to the animal (o). |
| Nora, investments in animal welfare, 10 years (30 / 40) | +Investments in animal welfare and comfortable living conditions in cattle barn (i). +Nora considered that rested bovines behave more calmly and produce more milk (i). +She talked to every cow during milking and called cows by name (o). -She mentioned a danger: kicks when milking a heifer (i). |
| Sara, devoted to animal work, 30 years (75 / 125) | +Cattle, different breeds, and cattle breeding were also a hobby for Sara, e.g., animal shows (o, i). +"I have a constant worry, if the circumstances of my cattle are not okay" (i). +She gave information, especially to her small children: bovine may be nice and friendly but also dangerous and can behave unexpectedly (i, o). +Bovines go out also during winter time (i), several successful animal transfers during the farm visit (o). -A near miss can be seen on video tape; fortunately Sara succeeds to give medicine to the bovine (o). |
| Susan, calm cattle handler, 7 years (29 / 56) | +Susan considered that people working in the cattle barn during the farming couple's holidays should have the same work style; if not, the cows may react, resulting in poor behavior and poor quality of milk (i). -A negative experience: being home alone when a large bovine escaped from fence; how to calm down the animal and avoid disturbance to other animals in the cattle barn (o). |

^[a] + = positive, - = negative, i = information from interview, and o = information from observation.

We included different barn designs in this study to find indications of trends in injuries for further hypothesis-driven research with larger samples. In our in-depth interviews and observations from a small sample, we could not observe differences; injuries had no apparent association with barn type. Ann (loose housing barn) and Mary (tie stall barn) reported several cases of injuries. The most severe injury occurred to Sara (loose housing barn with automatic milking system). Two respondents had worked on a dairy farm for a long time without any injuries: Brenda (loose housing cattle barn, previous sick leave 15 years ago during pregnancy) and Linda (tie stall barn, last injury with field machine 20 years ago).

Investments related to animal welfare (strategy 1) contribute to a more comfortable environment for the cattle, resulting in calmer behaviors and decreased stress. These

conditions make the working environment of a stockperson safer compared to a situation where, e.g., animals have to struggle with each other to get roughage.

On the basis of our findings and the four animal handling strategies identified, we suggest that the relationship between the stockperson and the cows has a significant role in the safety of cattle work. The respondents' experiences, our observations during farm visits, and reported injuries were considered in the framework of animal welfare science with the overall aim to improve occupational safety during animal handling. The findings regarding the respondents' relationship and interactions with cattle are represented in table 4. The recommendations presented later in this section have been connected to the results (strategies) in the previous section.

It is well known in animal welfare science that the stockperson is the key factor in farm animal welfare (Siegel and Gross, 2000; Hemsworth and Coleman, 1998). The stockperson or the farm operator (typically the same person on Finnish dairy farms) makes the animal handling decisions. Poor handling affects the animals, instills a fear of humans, and this in turn has an effect on the safety of the stockperson (Grandin, 1999; Raussi, 2003). Cattle are prey animals; thus, fear is part of their natural behavior (Grandin, 1999). A stockperson who hits and shouts will make cows fearful of people, and fear is a very strong stressor for an animal (Hemsworth and Coleman, 1998; Grandin, 1999). Cows distinguish individual people (Taylor and Davis, 1998) using multiple cues, such as body height or the face (Rybarczyk et al., 2001), just as a motivated stockperson can recognize individual cows. Rushen et al. (1999) showed that the mere presence of a person who has handled the cows negatively by hitting and shouting reduces the cows' milk yield compared with the presence of a person who has handled the cows positively by scratching them and talking in a gentle voice. Thus, cows can recognize a person who has handled them poorly and become generally fearful of people. A fearful cow can pose a danger to the stockperson because of its unexpected behavior (Grandin, 1999); it may panic, attack, or kick when trying to evade the stockperson (see strategy 4). Thus, fear should not be used as a way to effectively manage cows. During the ongoing structural change in dairy farming in Finland, methods to handle animals have become critical; new cow houses are usually loose housing barns in which stockpersons perform many tasks among free-moving animals. However, it is possible to recognize individual cows and treat them as individuals (Porcher, 2006). Active societal discussion in Finland has resulted in a demand for improvements in animal welfare and animal conditions on farms (Pentikäinen, 2008). At the same time, economic pressures have led farms to become larger (i.e., increased numbers of animals). The situation may be contradictory for farm entrepreneurs: do they have enough time to build a good relationship with their cattle, and do they have the capacity to take care of their occupational safety and well-being as well?

On the basis of our study and the literature concerning animal behavior, the following guidelines were developed to improve the occupational safety of stockpersons:

Habituate young calves to people through positive handling. The first days in the life of a calf are especially important in building trust with the animal (Jago et al., 1999). For example, when feeding the calf, the stockperson should communicate with it by scratching and talking in a calm voice (Raussi, 2003) (strategy 2).

The stockperson should be patient when working with cattle; hurrying may scare animals. The animals should have the possibility to move according to their own will. Under pressure, the animals may panic and rush in the barn, causing danger to a stockperson (strategy 2).

Cattle should not be dominated by force or by other means that make them fearful of people. Force and rough handling may seem effective, but in the long term they are not safe. Cattle have a large body mass. If a cow becomes afraid and rushes in panic, the stockperson is in real danger (Grandin, 1999). Instead, a positive relationship should be built with individual animals. Stockpersons should improve their knowledge of animal behavior, and observe the behavior of the cattle as a group as well as getting to know each animal and its behavior individually. The biological cost of the stress may become high for an animal if the stressor is continuous or repeated. Ultimately, this will negatively affect growth, disease resistance, and production (Moberg, 2000). In addition, the stockperson should not be afraid of cattle because the animals may recognize this fear. Moreover, a fearful stockperson may, for instance, behave too strictly, move too fast, shout, or exhibit threatening behavior (strategy 4).

Keep the physical conditions of the cattle barn animal-friendly. For example, stalls should be large and soft enough for cows to rest, with at least one stall per cow (Wierenga and Hopster, 1990). Loud noises and slippery floors should be avoided, thus keeping the barn environment calm. The ability of cattle to hear high-frequency sounds is much better than that of humans. Cattle hear sounds between 23 Hz and 37 kHz, and their best sensitivity is at 8000 Hz (Heffner, 1998). Watts and Stookey (2000) also reported that the ability of cattle to hear high frequencies is considerably better than that of humans. Cramped conditions in the barn are a problem; the social hierarchy of the herd may cause dangerous situations in a constrained environment. Often, the facilities in a barn are insufficient for submissive individuals to avoid the dominant animals. If a submissive and timid cow comes between a dominant threatening cow and a stockperson, it may rush in panic against the stockperson to avoid confrontation with the dominant animal (strategies 1, 3, and 4).

Cattle are gregarious animals and easier to move and transport as a group (Raussi, 2003). Avoid separating an individual animal, particularly if the animal has not previously been separated. Instead, if an individual animal needs to be separated, at least one familiar animal should be taken with it. Familiarity between cattle enhances their welfare (Færevik et al., 2007; Bouissou and Hövels, 1976) (strategies 1 and 2).

Cattle are responsive to positive, predictable routines in milking, feeding, and cleaning. Injuries to stockpersons often happen during cattle transport and special handling occasions. Therefore, animals should be trained to recognize the handling situations that they will face in the future (Grandin, 1999). Proper handling equipment and structures are of great help. Milking should be a pleasant event for cows to ensure the best possible milk let down and yield (Rushen et al., 1999). Even very small changes, e.g., along the route the animals take, may be frightening for a timid cow (Grandin, 1999). Cattle have a wide visual field, but they are not able to recognize the movements of a stockperson immediately behind them (i.e., the so-called blind spot) (Grandin, 1999). Thus, stockpersons approaching cows from behind should announce their presence, e.g., by talking (strategy 2).

The estrus period and the time just after calving may markedly change an animal's behavior because of changing hormonal status. A dam may attack even a familiar caretaker in an attempt to protect her calf (Grandin, 1999). Thus, in the calving pen, the stockperson should always keep the man-gate in mind and approach a cow cautiously. After parturition, the calf should be kept near the dam so that she does not feel the need to defend her calf. The stockperson should avoid being between a dam

and her calf, particularly shortly after birth. Sick or injured animals may also react aggressively toward the caretaker. Some means of self-defense is recommended while working among the animals. If a bovine attacks, the stockperson should raise hands, shout loudly, and/or use a rod or other means to deflect the situation (strategy 3).

Validity and Limitations

The small sample size in this qualitative study is a limitation to external validity. In order to improve the validity, we used data triangulation, augmenting our findings with other information sources such as statistics, literature, and existing theories (Laine et al., 2007). The material was gathered by interviews, observations, photographs, and notes, which comprised the triangulation in collection of information. The sample was not random but, by design, included different farm types from separate regions of Finland. The lead author conducted all farm visits and the expert interviews. The analyses and writing processes included contributions from other researchers and experts. Overall, the relatively extensive observations and interviews on each farm added to the reliability and level of detail of the research material.

Qualitative research has strengths in that it enables analyses of single cases more thoroughly. However, generalizations must be done with caution due to the limited sample size. Further research with larger samples investigating the influence of circumstances and behavior of stockpersons on safety and productivity in dairy farming would be useful. Utilizing skilled stockpersons as trainers and disseminating information about the positive relationship with farm animals would help young, untrained, or temporary stockpersons create a safe, animal-friendly working conditions in the barn.

Conclusion

Agriculture remains one of the most hazardous industry sectors, and farm animals are a major source of severe injuries. Nearly all respondents in our sample had suffered one or more injuries during the previous two years. Animals were often connected with the injuries and near misses, and were the most significant perceived injury hazard. We identified four animal handling strategies from observations among the study farms. Some women had worked years without injury. One important aspect of working safely is the trust and positive relationship between the cattle and the stockperson. We developed practical guidelines for stockpersons on the basis of our findings and animal welfare science to help build a good relationship between the cattle and the stockperson. These guidelines encourage the avoidance of animal stress caused by fear of humans. Improving the barn environment for cow comfort and worker safety will make it easier for the stockperson to interact positively with the animals. Animals that are handled roughly by stockpersons may suffer from fear stress that may lead to dangerous situations for the stockperson. However, in some situations, as in the calving pen, the stockperson should always keep the exit in mind and have something for self-defense while working among the animals.

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