

# Experiences and opinions of Danish livestock drivers transporting sows regarding fitness for transport and management choices relevant for animal welfare

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**ABSTRACT:** Including Denmark, modern pig production typically involves annual culling rates close to 50%. One important professional group in this process are livestock drivers transporting the animals to slaughter. By use of oral interviews, we aimed to describe experiences and opinions of Danish livestock drivers transporting sows, regarding fitness for transport and management choices relevant for animal welfare. All livestock drivers ( $N = 30$ ) associated with a large slaughterhouse in Denmark accepting sows were approached in person, after having unloaded sows, and asked questions by an interviewer. A total of 22 livestock drivers (73%) answered all questions, constituting of a heterogeneous group of men of varying age, level of experience, time since they achieved the legally required certificate of competence, and daily involvement in sow transportation. Among livestock drivers included in the present study, doubt about fitness for transport was not uncommon, and specific reasons underlying their doubt were listed. All respondents reported to have experienced having to reject loading a cull sow who had been selected for slaughter by a herd manager, and approximately 40% did this several times a year.

In contrast, almost 50% had never experienced having a sow rejected by the veterinarian at the slaughterhouse due to lack of fitness for transport. When asked about their management of sows during transportation, the majority (71%) reported using special condition transport (use of extra bedding and partitions to separate individual sows from rest of the load) less than once per month. All respondents considered hot days a problem for welfare of sows and the majority reported to adjust air intake of trucks daily or several times per week. In addition, approximately half of the respondents mentioned stationary periods (e.g., mandatory driver rests) as a challenge to sow welfare, to a degree where they had violated regulation on mandatory driver rests for the sake of welfare of the sows. The present study is among the few to focus on livestock drivers transporting sows, including questions about management choices and the animals' fitness for transport. The findings may form basis for future development of educational programs for drivers as well as for the formulation of hypotheses for future studies in this area, characterized by complicated underlying legislation and challenges to animal welfare.

**Key words:** animal transportation, animal welfare, cull sow, preslaughter logistic chain, slaughter

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## INTRODUCTION

In Denmark, more than 50% of the breeding sows are culled each year (SEGES, 2019a). Management of cull sows through the preslaughter logistic chain is not well described in the literature and may involve a number of potential challenges for animal welfare, production, and biosecurity. One very important professional group in this process is the livestock drivers, who are responsible for the welfare of the animals throughout the journey. However, within studies focusing on animal management and welfare, livestock drivers have received limited scientific attention (e.g., Burnard et al., 2015; Herskin et al., 2017; Dahl-Pedersen et al., 2018).

As reviewed by Grandin (2016), regulations and recommendations on livestock fitness for transport vary in different geographical regions. According to the European Regulation (Council Regulation 1/2005), not only farmers, but also livestock drivers and their haulier can be held legally responsible for the fitness for transport of livestock. Hence, before loading animals, the livestock driver has to decide whether an animal is fit for an intended journey and can be loaded onto the truck. In the scientific literature, fitness for transport is considered crucial for the protection of the welfare of animals during transport (Grandin, 2016; Cockram, 2019). However, as discussed by Dahl-Pedersen et al. (2018), no clear definition of fitness for transport is stated in the European Regulation (1/2005). Recently, international guidelines have been developed by groups of stakeholders (such as the voluntary European guidelines from Animal Transport Guides (Animal Transport Guides Project, 2016) or the World Organization for Animal Health (OIE) guidelines for transport of animals by land (OIE, 2016) to facilitate and align the assessment of fitness for transport across countries. However, Herskin et al. (2017) reported results from a questionnaire survey among Danish livestock drivers transporting cull dairy cows, showing that 35% of the respondents reported to be in doubt about fitness for transport. Similarly, in a recent questionnaire survey, Danish sow herd owners reported doubt about fitness of cull sows as well (Herskin et al., 2020). In addition, Dahl-Pedersen et al. (2018) showed relatively low agreement in the assessment of fitness for transport of cull dairy cows between veterinarians, farmers, and livestock drivers. Whether livestock drivers transporting sows face similar challenges is not known.

One potential challenge to animal welfare during transport is heat stress. In recent years, the negative consequences of heat stress on the welfare of swine has received a lot of scientific attention (e.g., Cabezon et al., 2017). Modern lactating sows are, due to their large litter sizes and high genetic potential for milk production, particularly sensitive toward heat stress (Brown-Brandl et al., 2014), especially close to weaning when milk production is peaking (Williams et al., 2013). Hence, sending sows to slaughter may involve thermal challenges, especially for lactating sows, and hyperthermia has been suggested to be a main reason for cull sow mortality upon arrival to slaughterhouses (Peterson et al., 2017). At present, it is unknown whether livestock drivers transporting sows to slaughter are aware of this challenge and/or how they address it.

In this study, we aimed to describe the experiences and opinions regarding fitness for transport and management choices relevant for animal welfare of Danish livestock drivers transporting sows to slaughter. This knowledge was obtained by use of an interview according to a specific protocol directed at to all livestock drivers transporting sows to a large commercial sow slaughterhouse in Denmark.

## MATERIALS AND METHODS

This study included all livestock drivers ( $N = 30$ ) transporting sows for slaughter to a commercial sow slaughterhouse in Denmark, slaughtering approximately 45% of Danish sows in 2018. The company allowed us access to their list of drivers. In agreement with the company, drivers were approached after unloading sows and questioned orally over a period of 2 wk during the spring of 2018. All participants were asked exactly the same questions, and all other topics of conversation were kept to a minimum. All answers were written down by the interviewer during the questioning. In the weeks before the questioning, all hauliers employing the livestock drivers were contacted via email and informed about the project, its methods and aims. This information was sent to the hauliers by the slaughtering company, but otherwise the company did not have any influence on the choice of or formulation of the questions.

The information obtained in this study had two purposes; to gain new information about experiences and opinions of livestock drivers, and to inform and qualify future studies planned as part of an on-going research project. In total, the drivers were asked 30 questions. Seven of these were

specifically targeting issues related to the future studies, and these answers are not reported here. Of the remaining 23 questions (given in [Table 1](#)), the initial four were demographic focusing on age, gender, experience, and number of years since receiving the legally required certificate of competence (as laid down in the European Regulation 1/2005). The estimated time to answer the questions was less than 10 min.

The results were subjected to descriptive statistical analyses and presented as proportions of answers, means, and when applicable the variability was expressed as ranges.

## RESULTS

### *Demographic Information about the Respondents*

In total, 22 livestock drivers answered all questions (response rate 73%). Three drivers missed 1–3 answers, but were included in the study with data for questions answered. [Table 1](#) shows the available options of answers for each question. All respondents were males of a mean age of 44 yr (range 25–66 yr); 32% were younger than 35 yr, 32% were between 35 and 50 yr, and 36% were older than 50 yr. [Table 2](#) lists the years of experience being a livestock driver transporting sows, as well as the number of years since the respondents received the legally required certificate of competence.

### *Frequency of and Number of Sows Transported to Slaughterhouse*

When asked about the number of sows transported to the slaughterhouse on the day of the interview, a mean of 72 sows (range 30–92) was reported. The livestock drivers reported a mean of 3.2 journeys to the slaughterhouse per week, ranging from 0.2 to 7.5 (e.g., because some only drove once per month and some drove more than one trip per day).

### *Fitness for Transport*

The livestock drivers were asked how often they had experienced rejecting loading a cull sow who had been selected for slaughter by a herd manager, and how often sows from their trucks had been rejected by the inspecting veterinarian upon arrival at the slaughterhouse due to lack of fitness for transport. According to national Danish legislation, a veterinarian employed by the authorities must do a visual inspection of all animals arriving

at a slaughterhouse. This is done for three reasons: to check for overt signs of disease and lack of suitability for human consumption, to check for symptoms of certain diseases that must be reported to the authorities, but also to check whether the animal is expected to have been fit for transport when leaving the herd. If not, for example in case of old injuries or shoulder ulcers, the veterinarian has to report the case and the driver can be legally charged ([Anonymous, 2019](#)). [Table 3](#) presents the answers illustrating a large variation. All livestock drivers had experienced having to reject loading sows who had been selected by a herd manager, but for 56% of the respondents this happened less than once per year. Approximately half of the respondents (48%) reported that they had never experienced rejection of a sow by the inspecting veterinarian at the slaughterhouse.

The livestock drivers were also asked about the main reasons for having to reject loading sows selected by a herd manager. No predetermined categories were used to guide the drivers' answers, and some drivers mentioned more than one reason. [Figure 1](#) lists the percentage of respondents reporting different reasons. The most frequent answers were related to leg problems (72%) and shoulder ulcers (36%), but umbilical hernia, wounds, hip displacement, large udders, and prolapse were also mentioned as clinical conditions underlying rejection of sows.

When asked the more general question “What factors are important when you decide whether a sow is fit for transport?”, the livestock drivers were given five different options with the possibility to select more than one. Here, 57% of the respondents answered “the risk of getting a fine” and 57% answered “the welfare of the sow.” Approximately a fourth of the drivers (26%) chose both these options. In addition, 17% chose “lack of option to separate the sow from other sows” and 9% chose “other.” No respondents chose “time.”

The next question focused on doubt about fitness for transport. The drivers were asked “When in doubt about fitness for transport—what is the reason?” Eight drivers (32%) reported to never experience any doubt. Five drivers (20%) stated that when they were in doubt, they did not load the sow. Seven drivers (28%) reported that they were sometimes in doubt, but they found it difficult to mention specific reasons. Among these drivers, answers such as “often a grey zone—where is the limit?” were typical. The specific reasons mentioned for being in doubt about fitness for transport were wounds, lameness, umbilical hernia, big udders, recumbent

**Table 1.** List of questions and answer categories presented in the questionnaire survey directed at livestock drivers in order to describe the experiences and opinions regarding fitness for transport and management choices relevant for animal welfare in Danish livestock drivers transporting cull sows to slaughter

	Question	Answer categories
1	Age	
2	Sex	
3	For how many years have you been transporting sows?	<1 yr 1–5 yr 6–10 yr >10 yr
4	When did you receive the required transports certificate?	<1 yr 1–5 yr 6–10 yr >10 yr
5	How many sows did you bring to the slaughterhouse today?	
6	How many loads of sows do you transport to the slaughterhouse per week?	
7	How often do you reject cull sows that have been selected for slaughter by the herd manager?	A) Several per month B) Several per yr C) Max 1 per yr D) Less than 1 per yr E) Never
8	What is the typical reason for rejecting a sow?	
9	When in doubt about fitness for transport—what is the reason for experiencing doubt?	
10 N = 23	What factors are important when you decide whether a sow is fit for transport?	A) Risk of fine B) Sow welfare C) Can't separate her from rest D) Time E) Other
11	Do you experience problems when the sows are loaded into the truck, and if so: which problems?	
12 N = 23	How often have you experienced that the veterinarian at the slaughterhouse has rejected the sow due to lack of fitness for transport?	Same categories as no. 7
13 N = 23	What was the problem the last time that you transported a sow that got rejected?	
14	How can the weather affect the welfare of the sows during transport to the slaughterhouse?	
15 N = 24	How often do you transport sows under special conditions (isolated from the rest, more bedding)?	A) Daily B) Several per week C) 1 per week D) 1 per 2 wk E) 1 per month F) More seldom G) Never
16	Which cull sows do you think would benefit from being transported under special conditions?	
17 N = 23	Does your workload increase, when the sows are transported under special conditions?	A) No B) A little C) Some D) A lot
18 N = 23	Does the rules about resting periods and driving affect the welfare of the sows?	Yes/no
19	Have you ever violated the rules about resting periods out of consideration for the sows on the truck	Yes/no
20 N = 23	Which of the listed factors do you believe to be most stressful for the sows during transportation?	A) High temperature B) Low temperature C) Long duration (number of hours not specified) D) Small roads, curves, bumps E) Stationary truck F) Other
21	Do you adjust the air intake for the sows during transports	Same categories as no. 15
22 N = 22	How often do you mix sows from more herds in the same section of the truck?	Same categories as no. 15
23	For how long do you typically wait to unload sows after arriving at the slaughterhouse?	<10 min 10–30 min 31–60 min >1 h

The number of respondents is 25, unless otherwise stated.

**Table 2.** Livestock drivers were asked for how many years they had been transporting sows, and when they received the required certificate of competence

	Years of experience transporting sows	Years since certificate of competence
<1 yr	3 (12%)	4 (16%)
1–5 yr	8 (32%)	10 (40%)
5–10 yr	0	4 (16%)
>10 yr	14 (56%)	7 (28%)

The table lists the number of and percentage of respondents per category. The question was answered by 25 drivers.

**Table 3.** Livestock drivers were asked how often they had experienced either to reject a cull sow having been selected for slaughter by the herd manager and experienced reporting of a cull sow by the inspecting veterinarian at the slaughterhouse due to lack of fitness for transport

	How often has a cull sow been rejected due to lack of fitness for transport?	
	By the livestock driver himself (N = 25)	By the veterinarian at slaughterhouse (N = 23)
Several per month	3 (12%)	0
Several per year	8 (32%)	4 (17%)
Max. once per year	0	4 (17%)
<1 per year	14 (56%)	4 (17%)
Never	0	11 (48%)

The table lists the numbers of and percentages of respondents per category.

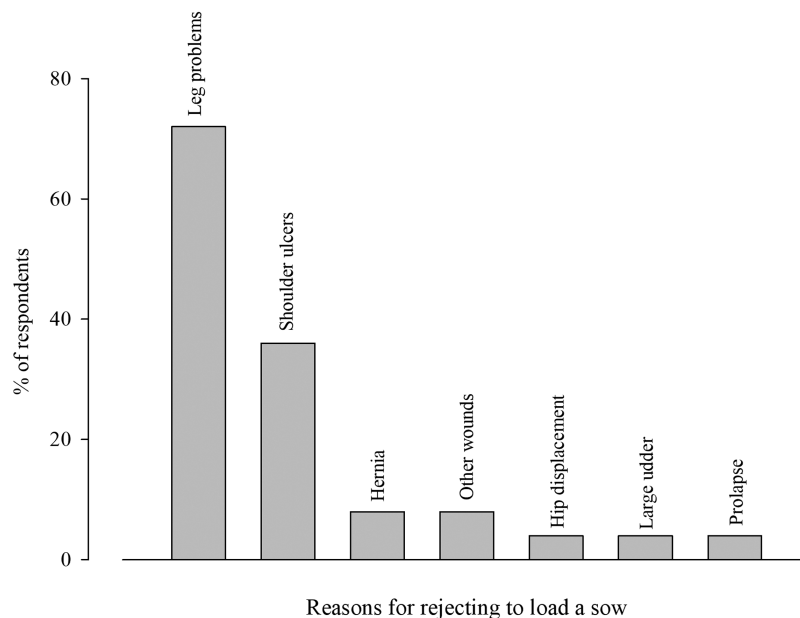
sows, old sows, sow with prolapse, young sows, and skinny sows. None of these options were reported by more than two drivers.

When asked about the last time a sow was reported by the inspecting veterinarian at the slaughterhouse, and the reason for this, the main answers were leg problems (38%) and “I don’t remember” (31%). The different answers and their frequencies are given in Table 4.

### Management Choices during Cull Sow Transportation

When asked whether they experienced problems during loading of sows, 32% of the livestock drivers reported “no,” and a total of 18% reported “sometimes or seldom.” Figure 2 lists the reported reasons.

According to Danish regulation, “sows that are slightly injured or slightly sick and will not succumb to further suffering due to transportation can be sent to slaughter, but require special conditions during the journey in terms of extra bedding and partitions to separate individuals from the rest of the load.” The livestock drivers were asked how often they used this opportunity while loading sows for transport. As given in Table 5, the answers were quite variable, with 29% of the drivers using special conditions at least every second week, whereas 71% answered once per month or less often, and



**Figure 1.** The livestock drivers were asked about the main reasons for rejecting to load sows, selected by herd managers for slaughter. No options were given. The figure lists the percentage of respondents reporting different reasons in a descending order.

17% reported that they never used this opportunity. When asked about a potential extra workload associated with the use of special conditions, 30% responded “no,” 65% “a little,” 4% “some,” and no drivers responded “a lot.”

Figure 3 shows the conditions listed by the livestock drivers when asked about which cull sows could benefit from being transported under special conditions. No predetermined categories were used to guide the drivers’ answers, and more than one reason could be given. The most frequently mentioned reason was leg problems (30%). However, 22% of the respondents answered none, emphasizing that no sows would benefit from transport under special conditions. In addition, 13% of the

respondents explained that they followed an all-or-nothing policy—either a sow was fit to join the others, or she was not fit at all and could not be transported.

When the livestock drivers were asked about potential effects of the weather on the sows, all of them responded that hot weather was challenging, and one added that cold weather could be so as well. Several of the drivers gave details on how hot weather during transportation could affect the sow. Here, open mouth breathing, increased lying behavior and “laziness” were suggested. In addition, some drivers mentioned increased inter-sow aggression, but also reduced aggression was mentioned. Some drivers reported solutions to transportation during hot weather, and provision of extra space, turning on the mechanical ventilation and seeking shade during stationary periods were mentioned.

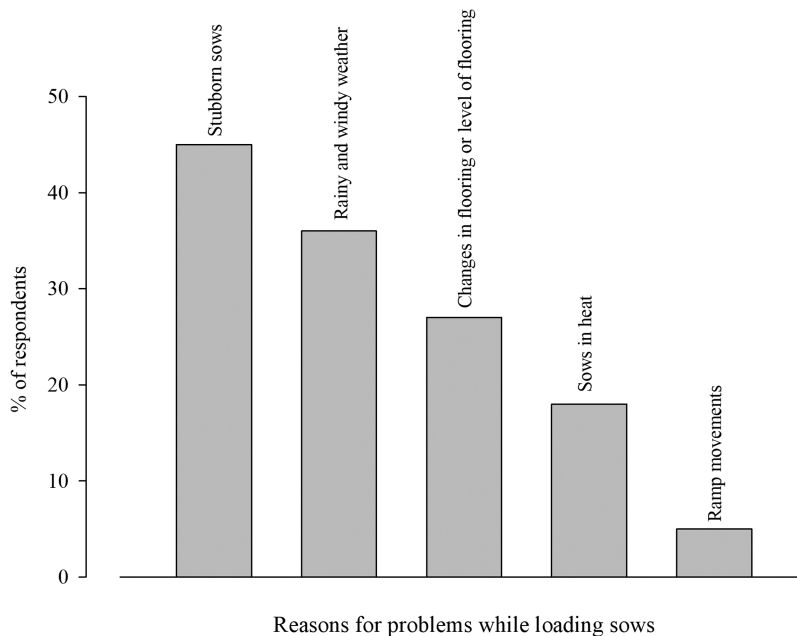
The livestock drivers were asked how often they adjusted the air intake of their trucks during journeys and stationary periods. This could be done by turning mechanical ventilators (fans) on/off or by adjusting the area of the ventilation openings. In the question to the drivers, it was not specified how. Table 5 shows the answers split into the seven categories in the questionnaire. The majority of the drivers (84%) reported to adjust air intake daily or several times per week, while 16% reported that they never adjusted the intake.

When asked a more general question about risk factors for the welfare of sows during transport,

**Table 4.** Reason for rejection of the last sow as unfit for transport by inspecting veterinarian at slaughterhouse

	Last sow reported by veterinarian at slaughterhouse
Leg problems	5 (38%)
Stress	2 (15%)
Actinomycosis in udder	1 (8%)
Stab wound	1 (8%)
Prolapse	1 (8%)
Do not remember	3 (23%)

Results are reported as the number of and percentage of livestock drivers who had experienced reporting of sows as unfit in each category (*N* = 13).

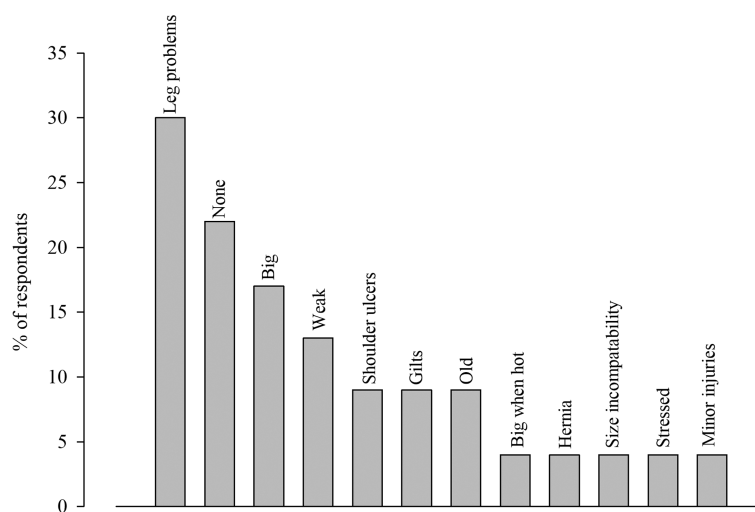


**Figure 2.** Reasons for problems during loading of sows listed by livestock drivers (percentages) (*N* = 22). Of the respondents, 32% reported that they did not experience problems at all, and a total of 18% reported problems occurring “seldom” or “sometimes.” No options were given and each respondent could give more than one reason for loading problems. The figure lists the percentage of respondents reporting different reasons.

**Table 5.** Livestock drivers were asked how often they: used the opportunities to give a sow special conditions during the journey, adjusted the air intake during journeys or breaks in journeys, and mixed sows from different herds in the same section of their truck

	Special conditions ( <i>N</i> = 24)	Adjust air intake ( <i>N</i> = 25)	Mix sows ( <i>N</i> = 22)
Daily	0	20 (80%)	20 (90%)
Several per week	0	1 (4%)	1 (5%)
Once per week	3 (12%)	0	0
Once per 2 wk	4 (17%)	0	0
Once per month	8 (33%)	0	0
More seldom	5 (21%)	0	0
Never	4 (17%)	4 (16%)	1 (5%)

The table lists the number of and percentage of respondents per category. For each question, the number of respondents is indicated.



Reasons listed for why sows can benefit from special conditions during transportation

**Figure 3.** Reasons or conditions listed why livestock drivers (*N* = 23) believed that a cull sow would benefit from being transported with special conditions (extra bedding and isolated from the other sows). No options were given and each respondent could give more than one. The figure lists the percentage of respondents reporting different reasons in a descending order.

the drivers were given six different options (listed in Table 1) with the possibility to select more than one as well as a possibility to comment. Most respondents (87%) listed high temperature as a stressor, 9% listed stationary periods, 4% listed long transport duration, and 13% listed “other.” No respondents chose low temperature or road conditions (small roads, curves, bumps) as risk factors for the sows. Among the respondents mentioning stationary periods, special emphasis was put on the 45 min rest break after driving for 4½ h, required by European law, due to road safety for the drivers (Council Regulation 561/2006). Among the comments were “I plan my days, so that I rest before loading,” “When it is hot, I don’t pause, I just drive,” and “Difficult to find shade for the truck during the rest breaks.” Two questions focused specifically on these mandatory 45 min rest breaks. When asked whether the rest breaks affect the welfare of sows during transportation, 60% responded “yes.” When

asked whether the livestock drivers had ever violated the regulation regarding mandatory driver rest breaks for the sake of the welfare of the sows, 44% answered “yes.”

The livestock drivers were asked how often they mixed sows from different herds in their trucks. Here, 95% of the respondents answered daily or several times per week, and only one driver answered “never” (Table 5).

The last question regarded the waiting time before unloading at the slaughterhouse. Here, the drivers were given four options. Sixteen percent answered “less than 10 min”, 76% “10–30 min,” 8% “31–60 min,” and no drivers “>60 minutes.”

## DISCUSSION

The aim of this study was to describe the experiences and opinions of livestock drivers transporting sows to slaughter regarding fitness for

transport and management choices relevant for animal welfare. Data were collected by approaching all livestock drivers in person ( $N = 30$  of which 73% answered all questions) transporting sows to a large commercial sow slaughterhouse in Denmark, and asking them 23 questions related to the aim. Overall, the results show that drivers transporting cull sows consisted of a group of men of different ages, with different levels of experience and considerable variation in the time since they achieved the legally required certificate of competence. All respondents reported having experienced rejecting loading a cull sow selected for slaughter by a herd manager, while almost half of the respondents had never experienced getting a sow reported by the inspecting veterinarian at the slaughterhouse. When asked about their management of the sows during transportation, 71% used special condition transport once per month or less often, and all respondents considered hot days a challenge for the welfare of the sows. A considerable proportion of the respondents reported to take different actions in order to limit the welfare consequences of heat stress for the sows.

Among the livestock drivers answering the questions, doubt about fitness for transport was not uncommon, and deciding whether a cull sow is fit for transport was described by some as a gray zone. These answers are not unexpected, as cull sows may be weakened or clinically challenged by their productive life (Fogsgaard et al., 2018), and thus less fit for transport than other types of swine (Grandin, 2016). Considering the short education required to obtain the legally required certificate of competence to drive livestock (in Denmark it is a 5-d course, but differs in extent within the EU), drivers are likely to rely on their own practical experience of loading sows to make a judgment about whether a sow is fit or not. Recently, Herskin et al. (2017) surveyed the knowledge of Danish livestock drivers transporting dairy cows. Here, it was often stated that peer-to-peer training was a typical way for them to learn about animal fitness for transport. In addition, they obtained information from the veterinarians performing the live inspections at the slaughterhouses. In the present study, almost one third of the respondents said they never experienced doubt about fitness for transport of sows, and 20% of them described how they used an “all-or-nothing” policy, where sows were either considered fit to be transported with a group of other sows or not fit at all. The finding that all respondents had experienced rejecting a cull sow selected for slaughter by a herd manager (and that approximately 40% did

this several times a year) but that almost 50% of the respondents had never experienced having a sow reported by the inspecting veterinarian at the slaughterhouse, is interesting. However, at the present stage—where knowledge about individual sows or opinions/experiences of the veterinarians in the same cases is not available—this is difficult to explain.

Even though it was not stated explicitly by the respondents, the use of such an “all-or-nothing” policy may have been one part of the explanation for the very low use of special condition transport for slightly injured/sick sows. More than two thirds of the respondents reported to use this possibility maximum once per month and 17% reported that they never used it. Based on the previously mentioned clinical characteristics of cull sows (Fogsgaard et al., 2018) it seems unlikely that livestock drivers only see very few slightly injured sows. However, recently, Cockram (2019) reviewed the scientific literature on fitness for transport in livestock. He argues that effectiveness of driver-initiated initiatives, to avoid additional suffering likely to be associated with transport of a compromised animal are questionable, and that there are different views about the types of conditions that constitute a compromised animal. In our recent survey among farmers delivering sows to the same slaughterhouse as in the present study (Herskin et al., 2020), the reported use of the special condition transport was even lower than in the present one. Only 8% of 360 farmers stated that their sows were transported under special conditions more than once per year. In the Danish preslaughter logistic chain, farmers have to alert drivers in advance about sows in need of special condition transport, in order for the driver to bring along the required partitions allowing sows to be kept individually during the journey. Thus, it is possible that the low use of this possibility was related more to the actions of the farmers, than to the drivers’ initiatives. In both professional groups, however, almost half of the respondents answered “no” when asked whether the opportunity was benefitting the welfare of the sows, so there seems to be alignment between the professions here. The lack of belief in the effects of special condition transport, however, could also explain the reported low use. At present, no studies are available to clarify whether use of special condition transport for slightly injured/sick sows is beneficial, and further studies are needed to clarify whether the present finding of a very low use is common, and to fully understand reasons underlying the low use of this opportunity.



The present study is characterized by a rather low target population size. At present, it is not known how many livestock drivers are driving sows in Denmark, but the slaughterhouse involved in the study slaughtered approximately 45% of the sows in the country in 2018. Among the rest, some sows die on farm or are euthanized by farmers, and hence not transported (in 2018, the sum of dead and euthanized sows was 12.6% (SEGES, 2019b). Among the remaining sows, some are exported for slaughter (approximately 5% (SEGES, 2019c)). Thus, even though the current data set includes answers from only 22 livestock drivers, constituting 73% of the drivers transporting sows to this slaughterhouse, these drivers may constitute close to half of the whole target population of this professional group in the country. In addition, the inclusion of some open questions means that this work has some semi-qualitative characteristics, which adds to the interpretation of the outcomes and where small sample sizes are the standard (e.g., Burnard et al. (2015) interviewing six livestock drivers transporting sheep).

Contrary to many other questionnaire surveys within animal science (e.g., Thomsen et al., 2012, 2016; Ison and Rutherford, 2014), the present study was not based on an on-line questionnaire, but on a live, oral interview. This way to approach the respondents was chosen in order to increase response rate. However, it is possible that the physical presence of the interviewer increased the risk of response bias (Paulhus, 2002), in terms of, for example, socially desirable responding (Holden and Passey, 2010), such as the motivation to confess breaking the law. In order to control for such bias, different methods to identify overclaiming have been developed (Bing et al., 2011), but were not included in the present work and would probably have warranted a larger sample size to be reliable.

One question, where the validity of the answers can be evaluated to some extent, relates to the time the trucks are typically waiting at the slaughterhouse before sows are unloaded. In a study performed in 2015 at the same slaughterhouse, the waiting time of 46 trucks arriving at the slaughterhouse during a 1-yr period was quantified (Thodberg et al., 2019). In that study, the mean duration of waiting from arriving at the slaughterhouse and until the last sow was unloaded was  $33 \pm 16$  min (range 0–78 min). In the present study, it was not specified whether the waiting time included the unloading of sows or not, but the answers from the respondents seem to be in line with the study by Thodberg et al. (2019), and thus suggest that at least this answer was not affected by response bias or overclaiming.

Irrespective of possibilities for overclaiming, the waiting time for the sows from arrival at the slaughterhouse to unloading is important from both an animal welfare and a logistic perspective. Thodberg et al. (2019) found that a long waiting time was a risk factor for a deterioration of the clinical condition of sows during journeys to slaughter. Hence, considering the vulnerability of some cull sows in terms of heat and transport stress (Cabezón et al., 2017; Thodberg et al., 2019) it is important to keep the waiting time in trucks before unloading at slaughterhouses at a minimum.

Interestingly, one clinical condition mentioned as a reason to reject sows and as a cause of doubt about fitness for transport was large udders. In the European Regulation on animal transportation (1/2005), it is specifically stated that lactating dairy cows should be milked every 12 h during transportation, and in the last few years the process of drying-off is receiving increasing scientific interest as a potential challenge to dairy cow welfare (e.g., Zobel et al., 2015). The accumulation of milk in the udder in the days after the last milking is among the reasons underlying this concern (e.g., Leitner et al., 2007). Sows are often sent to slaughter on one of the first days after weaning (Fogsgaard et al., 2018), where milk production is peaking (Williams et al., 2013). Despite this practice, the potential for on-going milk production, as well as the accumulation of milk in the udder, does not seem to have been discussed before in the context of limiting fitness for transport in sows. In accordance with this, none of the 360 sow farmers who answered questions about sow transportation in the recent survey by Herskin et al. (2020), chose “on-going lactation” as a cause of doubt regarding fitness for transport. The findings of the present study suggest that at least some of the livestock drivers did consider this clinical condition a challenge for the sows during transportation. Whether being transported shortly after weaning is challenging for cull sows is, to the best of our knowledge, not known.

One example of large differences in the answers from farmers (Herskin et al., 2020) and livestock drivers concerns the risk of heat stress for sows during transportation. Looking at the answers to several of the questions involved in the present survey (mentioned at least once as part of the answers to questions number 8, 14, 16, 18, and 20), it was clear that the drivers did consider hot weather a challenge to the welfare of the sows during transportation. In contrast to this, only 5% of the farmers chose “large influence,” when asked about the weather as a challenge for the sows, and 81% chose “no” or

“slight” influence (Herskin et al., 2020). The reasons for this difference are at present unclear, but may relate to the fact that drivers follow the sows on the journey and upon arrival, whereas farmers do not. Somewhat comparably, Whiting and Brandt (2002) reported that Canadian livestock drivers took the special needs of cull sows during transportation into concern when planning the loading density. In a recent Danish study on sow transportation, Thodberg et al. (2019) reported signs of dehydration in sows after journeys of up to 8 h when temperatures were as low as 15 °C. Peterson et al. (2017) presented US sow mortality upon arrival to slaughterhouses, and suggested that hyperthermia was an important component. Recently, Robbins et al. (2019) presented evidence suggesting that sows (in an experimental setting, not related to transportation) preferred to stay in temperatures between 13 and 16 °C, when given a free choice between areas with temperatures varying from 10 to 31 °C. Hence, further studies are needed to examine welfare consequences of transportation of sows on hot days, as well as to find possible solutions. In the present study, provision of extra space, and the avoidance of stationary periods were mentioned by the livestock drivers, of which 84% also reported to adjust the air intake in the truck daily or several times per week.

Across the results of the present study, some of the livestock drivers seemed aware and concerned about known risk factors for animal welfare during transportation of sows. One example is the risk of heat stress. When questioned about potential factors leading to stress, and given the option to choose among six different ones, the vast majority chose high temperature. Among the other possibilities were transport duration (very important in policy making, though perhaps not so well-documented as a single risk factor in the scientific literature (e.g., reviewed by Bench et al. (2016) in market weight pigs), and this factor was only chosen by 4% of the respondents. It may, however, be noted here that the respondents in the present study transported sows in Denmark, where national legislation stipulates that these sows are only fit for transport of up to 8 h (Anonymous, 2019). The drivers may have focused on this interval and not taken long-term transportation into consideration. Additionally, based on the results from Thodberg et al. (2019), suggesting that stationary periods can be a risk factor for clinical deterioration in sows after transport, stationary periods were listed as another option. During journeys to slaughterhouses, stationary periods may have several causes, but some

are mandatory rests of 45 min after every 4.5 h driving (required by European Regulation (Council Regulation 561/2006)). Both in their answers to question 20, and also in later questions specifically targeting these breaks, some drivers demonstrated concern for the welfare of the sows while kept in a stationary truck, and reported trying to avoid resting with animals onboard, finding shaded areas for the stationary periods or even violating the mandatory break for the sake of the welfare of the sows.

Whether they are on the road or parked during mandatory rests, livestock drivers are among the most publicly visible professional groups in animal production of today. One important ambition for the agricultural industry is to engage in societal dialogue (Christoph-Schulz, 2018). However, as discussed by Dürnberger (2019), successful dialogue cannot be achieved without knowledge to qualify the communication. In the present survey, the livestock drivers were asked how long ago they received the legally required certificate of competence. For almost half of the respondents, this happened more than 5 yr ago. In a comparable questionnaire survey focusing on livestock drivers transporting cull dairy cows, Herskin et al. (2017) found that only 52% of their respondents were able to correctly answer two specific questions concerning fitness for transport. Recently, Budzik and Budzik (2019) presented results from a questionnaire survey directed at Polish livestock drivers, and concluded that the drivers did not have full knowledge about animal welfare and did not understand its significance in terms of its potential for sustainable development within the transport sector. In the present study, the livestock drivers were not asked about their level of knowledge as such, or whether they wanted a higher level, but Burnard et al. (2015) (after interviewing six French sheep drivers in a qualitative study), stated that the drivers in their study requested more formal training. In general, it is recommended that training of animal caretakers is repeated at regular intervals in order to maintain their education and knowledge (Grandin, 2016). In light of this, it may seem surprising that the training required for European livestock drivers regarding fitness for transport is not followed-up. Based on experiences from German farmers communicating on social media, Dürnberger (2019) reported that the farmers experienced violent and personally insulting criticism when sharing news and events from their profession. In recent years, the concept of One Welfare—recognizing the interconnection between animal welfare, human well-being, and the environment

(Pinillos et al., 2016; Buller et al., 2018)—has received increasing attention as part of the agenda to live up to the UN Sustainable Development Goals (SDGs; Velarde et al., 2015). One of the SDGs is to create and develop decent jobs for people, and a recent Swedish study, focusing on how livestock drivers handle pigs during loading and unloading, concluded that further education of the drivers is needed to achieve improvements in animal welfare, improved working conditions as well as work satisfaction (Wilhelmsson et al., 2019). To the best of our knowledge, no scientific studies have focused on whether and how livestock drivers communicate publicly about their profession, and no knowledge exists on how society responds to this. One way to achieve such understanding of the perspectives of different stakeholders may be via qualitative, interdisciplinary studies.

In conclusion, this article is the first to describe experiences and opinions regarding fitness for transport and management choices relevant for animal welfare in livestock drivers transporting sows to slaughter and included, despite a relatively low sample size, 73% of all livestock drivers associated with a large slaughterhouse in Denmark accepting sows. The drivers were a heterogeneous group of men of varying age, level of experience, time since they achieved the legally required certificate of competence and daily involvement in sow transportation. Among the livestock drivers included in the present study, doubt about fitness for transport was not uncommon, and specific reasons underlying their doubt were listed. Some drivers were aware of, and concerned about, known risk factors for animal welfare during transportation of sows. The findings may be used for future development of educational programs for this professional group as well as for the formulation of hypotheses for future studies in this area, characterized by complicated underlying legislation and challenges to animal welfare.

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