Improving the Attitudes and Behavior of Stockpersons Toward Pigs and the Subsequent Influence on Animal Behavior and Production Characteristics of Commercial Finishing Pigs in Ohio

DISSERTATION

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ABSTRACT

The U.S. swine industry has changed dramatically in recent decades and the changes have led to a shift in the manner in which pigs are raised. The use of production contracts has become increasingly popular, which has led to a greater percentage of stockpersons raising pigs only from weaning or feeder size through the end of production. The stockpersons that undertake the production contracts are specialized in the one area of production and may have never worked with pigs in any capacity. Industry changes in size of production units and number of producers marketing hog(s) have been characterized; however, what is not known is information about the stockpersons. Therefore, the aim of this research was to characterize stockpersons in Ohio with regard to their demographics, attitudes, beliefs and their subsequent behavior toward pigs, and the reaction the pigs toward humans as measured by stroll test methodology and cortisol concentrations measured in the saliva.

The stockpersons varied with respect to their demographics, their pig experience, other forms of employment besides contract hog production, and, when observed interacting with their pigs, the location from where and how long they observed the pigs in their given facility. In addition, the stroll test response data and cortisol concentration results varied across farms. Furthermore, questionnaire results revealed that there were differences among stockpersons with regard to their attitudes and beliefs about pigs and
about working with pigs. With the differences in stockpersons in mind, a pig handling training program, directed specifically at attitudes and beliefs of stockpersons toward pigs, was implemented for a sample half of study participants to determine if the attitudes and the behavior of the stockpersons could be improved.

After the implementation of the training program, stockpersons that completed the training program had an improvement in indicator variables related to their positive attitude toward pigs and also increased the neutral behavior characteristics while reducing their negative behaviors toward pigs. Based on the results of the present study, the implementation of a training program, specifically addressing stockpersons raising pigs under a production contracts or raising only finishing stage swine, would be beneficial to the welfare of the pigs under their control and also enhance job satisfaction of the stockpersons.
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CHAPTER 1: REVIEW OF LITERATURE

Introduction

The United States Swine Industry

The United States (U.S.) has a large swine industry that has seen substantial change over the last 50 years, where the total number of operations raising swine and the number of swine at each operation has seen dramatic changes. In 1961, the U.S. marketed over 74 million hogs for a total of 13 million pounds of pork compared to 113 million hogs in 2009 for a total of 23 million pounds of pork produced (National Pork Board, 2011).

In 1961, there were over 1 million operations that raised swine and by 2010 there were approximately 65,000 operations that raised swine as seen in Figure 1 (National Pork Board, 2011). When the number of operations is divided into smaller groupings, vast differences among the groups are noticeable. The total number of operations marketing between 1 to 99 hogs per year was just over 50,000, whereas the total number of operations marketing over 50,000 hogs per year is approximately 130 (Figure 2). However, the operations that market over 50,000 hogs per year control over 56% of the total U.S. swine inventory (Grimes and Lawrence, 2007).
Figure 1. U.S. Swine Operations from 1965-2010

Figure 2. Swine Operation Size
These changes have been made because of advances in housing systems and production science. In the middle of the 20th century pigs were housed in extensive outdoor systems that were often using sow huts. Many farms would have had enough animals to feed their family and perhaps sell some at a market. With the progression of indoor housing, more pigs could be kept in the same area.

The U.S. Swine Industry and Marketing Contracts

The use of production contracts has become common in almost all agricultural industries and has changed the landscape of the swine industry. In the U.S. swine industry the total number of hogs produced under contract increased from 30% in 1997 to 46% in 2006 (Figure 4; Lawrence and Grimes, 2007). Production contracts have made it possible for operations to grow in size and scale because the company that owns the animals is able to increase total pig numbers without an increase in capital. Because of the increase in the total number of pigs owned by an operation, the need for more...
stockpeople to raise the pigs was created. A production contract is unique as they specify in detail the production inputs supplied by the contractor (processor, feed mill, other farm operation or business), the quality and quantity of a particular commodity, and the type of compensation to the grower (contractee) for services rendered (USDA, 2011). Because of these changes, many stockpeople decided to forego caring for sows and raising weanling pigs at their own operation and decided to become a contract stockperson instead. The contract stockpeople provide the fixed cost items at their operation and the contract marketing company provides the pigs, the feed, medicine, market access, and management.

![Figure 4. Number of Hogs Marketed by Contract Companies](image)

**Contract Stockpeople and Training**

The increase in the total number of hogs produced under contract means that stockpeople have been recruited to raise the pigs from either weaning age or as a feeder pig until market. When companies search for stockpeople to raise their pigs, the type of training that they will administer to the stockpeople varies by the size of the company.
Companies that market between 1,000 and 50,000 hogs per year tend to search for stockpeople that have experience and will require little training from the contracting company. However, contract companies that raise between 50,000 and 500,000 hogs search for stockpeople that do not necessarily have experience raising swine, but are willing to train the stockpeople. Finally, the largest contract companies, those that market over 500,000 hogs per year, are searching for stockpeople that can train and supervise closely and they are less concerned about the experience that the stockpeople already have with pigs (Lawrence and Grimes, 2007).

Animal Welfare

Welfare Concerns in the Swine Industry

The majority of the swine welfare concerns in the U.S. have been directed at the portion of the industry that involves the housing of sows. In recent years, animal rights groups in the U.S. have put forth referendums in multiple states including Florida,
Arizona, Colorado, California, Ohio, and Michigan that have mainly been focused on sow housing in the swine industry. While this is the focal point of these groups, there is always the possibility that they will move onto other areas of the swine industry that they consider to be inappropriate. Piglet weaning age, castration, tail-docking, or how the animals are handled could all be possible targets for these groups. In addition, the animal rights groups have published multiple undercover videos from farms where abuse is shown in some cases, but in other cases may be taken out of context because they may be viewed differently by the public and not taken in the context of animal husbandry (Mercy for Animals, 2011; People for the Ethical Treatment of Animals, 2011). What is clear is that animal welfare concerns will continue to be topics of discussion and disagreement.

Assessing Animal Welfare

The assessment of animal welfare can pose quite a conundrum to animal welfare scientists, who often struggle to agree on the definition of “proper” welfare. A widely accepted definition for welfare from Broom (1986) is, “the welfare of an individual is its state as regards its attempts to cope with its environment.”

During the animal welfare referendum discussions in the U.S., a divide between those that believe that production/reproduction should be the leading determinant of animal welfare and those that believe in evaluating multiple animal-centric variables in addition to production/reproduction has been present. The issue of the use of gestation stalls is an example of one of these disagreements. If animals are stressed heavily, they will not have the same ‘output’ in relation to production, or reproduction characteristics, as those that are not stressed (Curtis, 2007). For sows in gestation stalls, production, as measured by number of pigs saved per litter, is higher than ever in the U.S. (National
Pork Board, 2011), which, for those that believe that production outcomes should drive animal welfare decisions, shows that gestation stalls are perfectly suitable for the sows. However, for those that use the principles put forth in the Brambell report (the “five-freedoms”; Brambell, 1966), the use of gestation stalls may never be acceptable, regardless of the production values, because they believe that stalls do not meet one or more of the prescribed needs of the sow. The question of which group is correct is the crux of animal welfare debates.

There are multiple approaches to the measurement of animal welfare, and Barnett and Hemsworth (2003) detailed five approaches. They are 1) the feeling-based approach, 2) the animal-choices approach, 3) the nature of the species approach, 4) the freedoms for animals approach, and 5) the functioning-based approach (also known as the homeostasis approach). The research focus of the present study uses the functioning-based approach; therefore, the primary focus of the following section will be this approach.

The functioning-based approach (also known as the homeostasis approach) is based on the quote stated above, “the welfare of an individual is its state as regards its attempts to cope with its environment” (Broom, 1986). The approach is considered the homeostasis approach because it attempts to determine what an animal is doing to cope in its environment and also how successfully they are coping. This approach takes physiological measures such as reproductive success, weight gain, and illness prevalence into account to determine how well an animal is coping in its environment (Barnett and Hemsworth, 2003). Function-based assessment of welfare is quite useful for assessing large differences in welfare (very good or very poor); however; it may not be as sensitive for determining smaller differences in welfare.
Functioning-based assessment of welfare has been demonstrated to be feasible for use in an industry production setting whereby potentially large variation within and among systems is to be expected. Working with stockpersons in the industry provides a “real-world” setting that can be beneficial to research because it is a measure of what is happening in an industry setting.

Animal welfare is very complex and not easy to measure. Each one of the aforementioned approaches can be useful in determining at least a part of the complex animal welfare model. There are many contingencies that make measuring animal welfare difficult. First, the animals cannot verbally explain to humans what they would like. Second, each animal could have its own preferences concerning animal welfare. Third, there may be a limitation in our total knowledge of animal cognition, meaning that currently many scientists believe that animals have a very basic repertoire of feelings or emotions. Perhaps in the future, scientists will discover that animals are capable of experiencing or demonstrating more emotions than currently known. If this were to happen, the science of animal welfare could change dramatically (Barnett and Hemsworth, 2003).

**Stress**

**Overview of Stress**

Moberg (1985) noted that the animal has biological and physiological reactions to stress. When there is an external threat to the animal, the central nervous system (CNS) assesses the challenge and reacts appropriately, followed by the body going through physiological and biological changes that are moderated. The CNS plays two vital roles in the body, the first is to detect a threat or a stressor and the second is to organize the
biological defense in the body. There are many factors that determine how the CNS will respond to a stressor including: age, past experiences, sex, and environment (Moberg, 1985). Each of these variables can affect the animal’s stress response by itself or in concert with one or more of the other variables.

When an animal feels threatened or fearful, natural instincts (such as fight or flight) are activated to protect the animal (Cannon, 1920). The fear stimulus could be an animal predator, a human, or a novel object. Broom and Johnson (2000) described the term stress as, “an environmental effect on an individual which overtaxes its control systems and reduces its fitness or appears likely to do so.” When an animal is stressed it attempts to retain homeostasis. The simplest way to accomplish this is for the animal to remove itself from the stressful situation. For instance, moving away from a dominant peer or moving from a hotter area to a cooler area.

Stratakis and Chrousos (1995) explained that there are two endocrine systems that work in the body, comprising the components of the stress response. One system releases epinephrine from the adrenal medulla and the second releases glucocorticoids from the adrenal cortex. Nelson (1995) described the stress response mechanisms of the hypothalamic-pituitary axis (HPA). At the first sense of a stressor, the adrenal medulla will release norepinephrine and the sympathetic nervous system will release epinephrine. Shortly after the release of norepinephrine and epinephrine, the hypothalamus releases corticotropin-releasing hormone (CRH) (and other releasing hormones), which stimulate the release of adrenocorticotropic hormone (ACTH) and β-endorphin from the anterior pituitary gland. Adrenocorticotropic hormone then stimulates the release of cortisol from
the adrenal cortex. Finally, prolactin is released from the anterior pituitary and vasopressin is released from the posterior pituitary (Figure 6.).

Figure 6. HPA Axis. (Adapted from Nelson, 1995)

The stress response has many adaptive effects such as: increased immediate availability of energy, increased oxygen intake, decreased blood flow to areas of the body that are not required for movement, the stopping of energy inefficient processes, decreasing pain perception, and enhancing memory and sensory function (Nelson, 1995).

**Consequences of Stress**

It is normal to have short bouts of stress, like a single loud sound or a short skirmish with a pen-mate. The body manages short-term stress well in most instances; however, it is chronic stress that can be the most harmful to the body. Consequences of chronic, long-term stress can include increased body temperature, immunosuppression, and hypertension (Nelson, 1995). The consequences of long-term stress may obviously have unfavorable welfare implications for animals, but there are also production repercussions to be considered. After the body has attempted to cope with stressful
situations for an extended period of time, the animal can enter a pathological state. Moberg (1985) described the term “pathology” as, “the existence of conditions that impair or threaten to impair the organism’s ability to maintain its normal functions and to reproduce.” The pathological state is after the animal has proceeded through the pre-pathological state - a state of vulnerability (Moberg, 1985). The magnitude and the duration of the change in biological function are part of what determines if the animal will enter into a pre-pathological state. Entering the pre-pathological state is dangerous for animals because the longer the animal stays in that state, the more likely it is to proceed on to the development of a pathology. For instance, if the reproductive hormones of an animal have been repressed because of a stressor, over time it could result in the lack of reproductive success (Moberg, 1985). When studying the effects of the stress response, it is easy to see how stressors can have such a negative effect on livestock welfare and potential for productivity.

**Measuring Stress**

Measurement or assessment of stress in animals can be complex because there are many factors to consider, including the animal’s age, gender, and previous experiences or exposure to stress-inducing phenomenon. In addition, in an individual animal, if the same stressor is applied multiple times the reaction to the stressor could be different each time. In addition, the same stressor might elicit different responses from different animals in like conditions because of inherent differences among animals (Moberg, 1985). Another consequence of chronic stress applied to an animal can be that the animal may adapt to the situation in which it is placed. Seyle (1950) formed the General Adaptation Syndrome, which consists of three stages: 1) the alarm reaction, 2) resistance, and finally
3) exhaustion. During the resistance stage, the body is coping with the stressor and in the exhaustion stage the animal’s stress response is terminated and there is an onset of stress pathology (Seyle, 1950).

![Figure 7. General Adaptation Syndrome](image)

However, in more recent research, it has been thought that the pathological effects of stress occur during the exhaustion phase due to the prolonged exposure to the hormones that are found in the stress response (Nelson, 2005). Because of this fact, hormones such as cortisol may have lowered concentrations even if the animal is in a stressful environment. The animal has exhausted its coping capabilities and no longer shows the same physiological response to stress. In summary, the information discussed in this section demonstrates that special care must be taken in experimental design, analysis, reporting of results, and describing conclusions when using data assessing an animal’s level of stress, and that monitoring multiple physiological and behavioral measures is likely necessary to deduce if the animal is experiencing stress (Moberg, 1985).
Cortisol

Stress hormones and their metabolites have been used extensively to aid in determining excitement or stress in both humans and animals. Cortisol is a hormone that is routinely used, and has been validated in the literature, to ascertain animal stress levels and welfare in livestock species, including swine. When the stressors override the body’s feedback systems, cortisol pulses increase in frequency and amplitude (Kirschbaum and Hellhamer, 1989). Kirschbaum and Hellhamer (1989) explained that cortisol, like many other hormones, is not released in a constant manner, but in a pulsatile fashion throughout the day. In many species, including swine, saliva cortisol concentrations are greatest in morning and lowest around midnight, and this pattern closely parallels the plasma cortisol patterns (Ruis et al., 1997). Multiple methods have been used to measure cortisol concentrations in the body including: blood (plasma), saliva, feces, urine, and feathers, with saliva and plasma being two of the most common. Plasma cortisol concentrations were used routinely, but scientists began to experiment with gathering saliva to determine cortisol concentrations instead of blood because it was less invasive. Cook et al. (1996) compared plasma and saliva cortisol concentrations in pigs for the assessment of adrenal activity in swine. They found a very high, positive correlation between plasma cortisol concentrations and the saliva cortisol concentrations.

Attempting to gather samples for cortisol concentration measurements can be stressful and care must be taken to ensure that cortisol concentrations being measured are not reactions to the stress of sample collection. For instance, Sorrels et al. (2007) noted significant differences in cortisol concentration between groups of pigs; however, there is the possibility that the difference was caused by the presence of an experimenter. Broom
and Johnson (2000) later stated that there is only a two-minute delay between initiation of a stressor and the time before cortisol is released into the system. Thus, saliva cortisol results should be viewed with caution, as there could be an interaction between the stress of the sampling method and the elevated cortisol concentrations. Therefore, standardization of protocols and appropriate statistical sampling within and across experiments is a critical step to maintain a level of confidence in cortisol as a measure or indicator of stress in animals.

Circadian rhythm, age, and stress all can affect a pig’s cortisol concentrations. Ruis et al. (1997) studied the effects of these variables on cortisol concentrations. There was a significant age effect where pigs at 12 weeks of age had higher (P < 0.05) acrophase concentrations than pigs at 16, 20, and 24 weeks of age, although the amplitude did not follow a similar statistical pattern. In addition, the acrophase for 12-week-old pigs was later in the day than older pigs (P < 0.05). As the pigs aged from 12 to 24 weeks of age, the MESOR decreased significantly (P < 0.05) from 1.19 ng/ml to 0.71 ng/ml. When looking at their results in total, the study indicated that as the pigs’ age increased, their cortisol concentrations more tightly follow a circadian rhythm.

In a housing study, Klont et al. (2001) investigated the effects of barren (conventional, slatted-flooring) or enriched (straw placed in the pen daily) environments on the pre-slaughter behavior, carcass characteristics, postmortem metabolism, and meat quality characteristics of pigs. Twenty-four pigs were used in each of two replicates. Three groups of four pigs (two barrows and two gilts) were each assigned to barren environment and three similar groups were assigned to the enriched environment. At 25 weeks, the groups of pigs (by replicate) were transported to an abattoir. Prior to lairage,
all pigs had saliva collected using cotton buds, which was used for baseline salivary cortisol concentrations. During lairage, video cameras recorded the behaviors of the pigs. Once the pigs arrived at the abattoir, a second set of saliva samples was collected from each pig to determine the change in salivary cortisol concentrations as a result of transport. For the purposes of this review, the focus will be on the salivary cortisol results. Pre-lairage, baseline salivary cortisol levels for pigs from the enriched environment were significantly greater (P < 0.01) than levels for pigs reared in the barren environment. However, after lairage, the groups had the same salivary cortisol concentrations. Therefore, when comparing the change in salivary cortisol (pre-lairage to post-lairage) there was a significant difference (P < 0.05) between the groups, whereby pigs in the barren environment had a greater increase in salivary cortisol due to the effect of or response to lairage. So, the study indicated that pigs in the enriched group were more capable or adaptable to dealing with the stress of lairage.

The present research was conducted in a production setting, which inherently entails working in a less-controlled setting than a laboratory setting may afford. Because of this fact, blood sampling would be too difficult to perform and also, because the pigs are the property of cooperators, there may be a liability issue if an invasive, blood collection procedure resulted in injury or death to a pig. While fecal material and urine have both become increasingly popular substrates for cortisol assessment, especially with non-domesticated species, because the collection methods do not induce stress in the animal (Royo et al., 2005; Hay and Mormede, 1998), the requirement of multiple, within day collection and homogenization precluded their use in the existing study. Therefore,
saliva collection, a non-invasive measure that does not require restraint of the pigs or additional personnel for sample collection, was the chosen approach in the present study.

Fear
Measurement of Fear of Humans

Fear is defined as, “a feeling of agitation and anxiety caused by the presence or imminence of danger” (The American Heritage Dictionary, 2001). In the case of pigs, they may feel that the presence of humans, items used in handling and movement within a farm, noises, or a number of other items and instances could be dangerous (even if it is not true). In livestock, fear is one variable that can be measured using endocrinology and also the behavior observations of the animals (Terlouw et al., 1997) and, when used in concert, an animal’s fear level can be assessed, whereas using a single variable alone may not be able to appropriately determine the level of fear in an animal. Perhaps the most common method of measuring fear of a human or a novel object is an avoidance test or an approach test. These tests mirror what an animal would naturally do in the presence of novel or fearful situations, which would be for the animal to flee objects or situations. If animals are fearful of humans they will be hesitant to approach the human, if they approach at all. Waiblinger et al. (2006) completed an extensive review of previous research and characterized tests that have been used to assess approach or avoidance responses by measuring 1) reactions to a stationary human, such as when a human is standing in a pen, 2) reactions to a moving human, when the human is moving in the pen, and 3) reactions to handling, where humans are physically working with the animals. These tests can be completed in the home pen (familiar confines) or in a novel pen (the
animal is taken to an unfamiliar pen). Reactions of the animals to approach and avoidance testing are measured to aid in determining the fear of humans. Distance from the experimenter, approaching the experimenter, latency to approach the experimenter, contact with the experimenter, number of contacts with the experimenter, and how the animal reacts to the specific handling are variables that can be used when assessing fear of humans. Research of this type has been conducted on pigs, dairy cattle, and chickens (Waiblinger et al., 2007). Fear of the experimenter could start a stress response that can negatively affect the animal by initiating endocrine and behavioral responses that have been previously discussed.

Effects of human handling on animals

Determination of the effect of Human Handling on Pigs

Research studies have helped define and classify the handling techniques used toward animals that are subsequently utilized in the present study. Hemsworth et al. (1986) found that differences in human handling can affect animal approach behavior to a human experimenter. The treatment groups were: 1) unpleasant handling (the pigs were shocked whenever they approached the experimenter), 2) minimal (no handling outside of the normal tasks), and 3) pleasant handling (pigs were stroked and petted when they approached the experimenter). At 14 weeks of age, the pigs from the unpleasant handling group took longer to approach to within 0.5 meters of the experimenter, spent less time within 0.5 meters of the experimenter, took longer to initiate interaction with the experimenter, and they had fewer interactions with the experimenter. At 18 weeks of age, the unpleasantly handled pigs took longer to enter into 0.5 meters of the experimenter and took longer to interact with the experimenter than either the minimally or pleasantly
handled groups. The unpleasantly handled pigs also had fewer interactions with experimenter than the pleasantly handled group. Pleasantly handled gilts were reported to have a greater pregnancy rate when measured between 40 and 60 days post-mating than the unpleasantly handled gilts (33.3% unpleasant, 87.5% pleasant). At 23 weeks of age, the boars that were pleasantly handled in the experiment had larger testicles than boars that were unpleasantly handled (unpleasant 53.2 ± 2.44 cm², pleasant 63.3 ± 1.96 cm²).

In similar research by Gonyou et al. (1986), gilts were separated into four groups and each group was exposed to a different type of human handling behavior: 1) positive (an experimenter crouching, bare-handed, and patted the gilts when they came within a close range of the experimenter with rubs and pats), 2) negative (an experimenter standing erect with gloved-hands, and reached out and touched the snouts or forehead of the gilts), 3) minimal (minimal human presence in the pen and the only human contact was during weekly cleaning), and 4) aversive (an experimenter would stand erect and wear gloves and use an electric prod to shock any pig that approached the experimenter or failed to flee from the experimenter). In the group test, the aversively handled pigs took longer to approach the experimenter, spent less time around the experimenter and had fewer interactions with the experimenter than the positively or minimally handled groups. Similarly, for the individual approach test, there were differences among the four groups with regards to approach behavior, where the negatively and aversively handled gilts took longer to initiate contact with the experimenter than the positively handled gilts. In addition, aversively handled gilts spent less time within 0.5 meters of the experimenter than the three other groups of gilts.
Paterson and Pearce (1989) studied differences between unpleasant handling and pleasant handling. For the pleasant handling treatment, the handler squatted in the corner of the pen and allowed the pigs to approach and interact with him for three minutes. No aversive signals were given towards the pigs during the handling treatment or during other routine procedures such as weighing. For the unpleasant handling group the handler would walk from one end of the pen to the other and then made ten traverses of the pen at 15-second intervals. If a pig approached the experimenter, a brief shock would be administered with an electric prod. For all measurements taken during the human approach testing, gilts that were unpleasantly handled showed more fearful reactions toward the experimenter than the gilts that were pleasantly handled, including taking a longer time to enter the area around the experimenter (P < 0.01), spending less time around the experimenter (P < 0.05), taking longer to initiate interaction with the experimenter (P < 0.01), and having fewer interactions with the experimenter (P < 0.05).

**Consequences of Human Handling Interactions**

The research by Hemsworth et al. (1986), Gonyou et al. (1999), and Paterson and Pearce (1989) helped to provide the basis for classifying interactions into categories including: aversive, positive, and neutral. In research reported by Hemsworth et al. (1991; 1994b) it was shown that when animals were handled with pleasant handling practices, they were less fearful of humans. Hemsworth et al. (1991) reported that the pigs that were handled with pleasant techniques (patting, stroking) had more advantageous feed conversion ratios and growth rates than pigs that were handled with aversive techniques (hits, kicks, slaps) in the first five weeks of the handling period. If animals are fearful of humans and attempt to flee, it is possible that they could incur injuries while in the pen,
during loading or unloading of a livestock trailer, or when a human is attempting to provide care, such as in a hospital pen. Injuries that are possible to pigs while being handled are often because of slips and falls or when the pigs are “piled-on”, which is when the pigs in the back are trying to move forward by mounting other pigs. During the period of mounting, the pig that is being mounted could be in danger because it could lose its balance or may not be able to support the weight and can fall, while the pig that is mounting could also slip and fall during the process. In addition, during a fearful situation, pigs may run into gate, twist and turn in non-normal ways, and increase the frequency of slips and falls, all of which increase the probability of injury, increased fear, and loss of productivity. Stockpeople in the present study anecdotally told of experiences where pigs fled the presence of humans by jumping over gating to enter the adjoining pen, thereby creating the potential for pig-pig aggression and attacks leading to injury or death, as is common when unfamiliar pigs are grouped. These consequences of fear highlight the importance of proper handling as a means to decrease fear levels and the potential for injury.

**Human Handling and Environmental Enrichment**

Pearce and Paterson (1989) investigated the effects of pleasant and unpleasant handling as well as the interactions of handling with an enriched or un-enriched environment. The enriched environment had four chains hanging from the ceiling, a bar loosely connected to the pen, and three rubber tires on the pen floor, while the un-enriched pen had conventional, concrete slatted-floors. The handling techniques for this research were the same as those described in Paterson and Pearce (1989) in this review. The treatment combinations were: 1) unpleasant handling in a normal environment 2)
unpleasant handling in an enriched environment, 3) pleasant handling in a normal environment, and 4) pleasant handling in an enriched environment. The results of the human approach testing showed that there were differences (P < 0.01) between those pigs that were handled pleasantly or unpleasantly, where the unpleasantly handled pigs took longer to approach within 0.5 meters of the experimenter, spent less time within 0.5 meters of the experimenter, took longer to interact and had fewer interactions with the stockperson.

Day et al. (2002) studied the effects of both handling and environmental enrichment in growing pigs. A 2 x 4 factorial design was used with two levels of handling variables (P: pleasant; M: minimal) and four levels of enrichment variables (B: barren; C: chain; S: chopped straw; T: destructible toy). For the pleasant handling variable, the stockperson would enter the pen at random between 09:00 and 09:45 hour daily for five minutes and stroke or pat any pigs that approached. For the minimal handling group, the pigs were handled with as minimal contact as possible, including auditory, visual, or tactile handling. The level of enrichment did not significantly affect any of the indices that were used to measure fear. Perhaps one reason that differences were found with only part of the approach/avoidance test, and not more, is because the pigs were handled either pleasantly or minimally and aversive handling was not tested. The results were similar to findings by Hemsworth et al. (1986) and Gonyou et al. (1986), where it was found that pigs that were handled aversively had a diminished approach behavior versus the pleasantly handled pigs, but the minimally handled pigs did not show significant differences from the pleasantly handled pigs. One hypothesis to consider would be that pigs that are minimally handled may still be fearful of humans because
they have not had any positive experiences to reinforce approach behavior or the opportunity to habituate to a more pleasant handling approach.

**Pigs Ability to Differentiate Human Handlers**

Hemsworth et al. (1994b) studied the ability of gilt pigs to differentiate between handlers when the pigs were handled by separate stockpeople that used the same types of treatment towards the gilts. Both handlers (one male, one female) followed similar routines, performed similar tasks, dressed similarly and were similar in physical size. In the experiment, the handlers handled the pigs on alternate days, five days a week for a period of six weeks initiated with pigs at 15 weeks of age. The handling bouts involved a mixture of positive and negative physical interactions by the handler at a ratio of 2:3 with 10 total physical interactions per day. The positive interactions consisted of pats, strokes, and a hand resting on the back, and the negative physical interactions were mild to forceful slaps and hits. The handling treatments were imposed along a route that took the pig from their home pens, along a corridor to another shed, and then back to the home pen.

The results showed that the animals do not differentiate between handlers and had no differences in approach behaviors in the human approach test, no differences in the measurements taken while being moved through a corridor and also no differences in growth rates between the two groups of pigs. Results also showed that the pigs that were most difficult to handle were the most fearful of humans. Since there was no difference found in the approach behaviors of pigs towards the handlers, it was proposed by the authors that in situations where pigs are handled aversively, even briefly, the behavioral response may extend to other humans. Extension of this hypothesis is of concern because
aversively handled pigs, even by one handler, may associate that type of treatment with all other humans, and therefore not respond when positive handling is applied.

Of note, the research reported by Hemsworth et al. (1994b) looked at individual pigs being handled by aversive or non-aversive handlers, while in contrast, Hemsworth et al. (1986), Gonyou et al. (1986), Paterson and Pearce (1989), and Pearce and Paterson (1989) studied the type of behaviors enacted towards the pigs. This difference is important because in the trial conducted by Hemsworth et al. (1994b) the researchers were testing the difference in approach behavior to an aversive or non-aversive handler, whereas, previously researchers studied the differences between aversive and non-aversive handling (not the differences between handlers). The importance of this distinction is that in human approach tests, pigs have been noted to not differentiate between handlers based on their handling style; however, it has been shown that aversive handling of pigs resulted in different human approach test responses than pigs that had been pleasantly handled.

**Human Handling in other Livestock Species**

Human handling experiments have been completed in both dairy cattle and chickens. Rushen et al. (1999) assessed handling methods during the dairy cows’ lactation periods, whereby one of two handlers always used positive behavior with the cows and the other handler used only negative behavior. The handlers wore a colored overall (either red or yellow) to help the animals maintain differentiation between the two handlers and also between the other farm help (who wore blue or gray overalls). Fear testing procedures were completed and results showed that at the initial handling interaction, there were no differences in cow approach behavior towards either treatment
handler. However, after subsequent handling sessions, the cows began to stand closer to the gentle handler. When a third handler, wearing green overalls, was presented to the cows, there was no difference in the distance that they stood from the handler. Heart rate monitoring was completed, and results indicated that cows had a greater increase in heart rate when the aversive handler was present at the time of milking, but there was no difference in milk yield/production due to the presence of either the positive handler or negative handler. The presence of the negative handler resulted in lower milk yield when compared with the presence of the control handler. In addition, when the cows were exposed to a handler that used aversive handling techniques, the cows had more residual milk yield, indicating that there was a smaller amount of marketable milk when compared with cows handled with positive actions. Of note, color of overalls did not influence the distance of the cows from the handler, rather cows stood closer to the positive handler than the aversive handler in the study.

Breuer et al. (2000) reported a negative correlation/association between aversive handling and milk yield in dairy cows. On farms where animals showed less approach behavior to the handler (increased fear of the handler), there were lower milk yields. This finding is important to animal welfare and animal welfare assessment approaches because it shows that the cows were able to recognize individual people and then become fearful of those people. The finding suggests that the presence of aversive/unpleasant handlers in the milking parlor will elicit fear responses in cows, and very likely, result in greater levels of milk residuals that ultimately are tied to reduced milk yield. While this finding is somewhat contrary to results that have been found with pigs, where the pigs have not differentiated between pleasant and unpleasant handlers (Hemsworth et al.,
1986, it is possible that because dairy cows are intensively handled, usually two or three times per day, perhaps the cows learn to differentiate an aversive handler from a gentle/pleasant handler. If pigs were handled in this manner, with singular, intensive contact occurring multiple times daily, they might also show this response. Either way, the comparative studies indicate that systematic assessment of animal fear, welfare, care are likely to be species dependent.

Gross and Siegel (1979) studied the adaptations of chickens to their handler. For the adaptation protocol, the handler approached the cage and spoke to the birds, the cage door was opened and the birds were stroked gently. It was found that chickens that were in the adaptation (to handling) group had a faster growth rate (24.5 grams/day versus 21.9 grams/day). It was also noted by the authors that if the birds would have been handled for more time each day, then perhaps the differences between the adaptation and non-adaptation group would be larger. This is important because it shows that the productivity of chickens can be affected by the daily interactions of their human handlers, and establishes a need for further research in alternate species.

In two separate studies by Barnett et al. (1992; 1994), the effect of humans on the production and behavior of egg-laying hens was examined, with results indicative of the influence of human behavior on hen behavior and production. In the 1992 study, fear of humans accounted for between 23% and 63% of the variation in production output variables. In the 1994 study, it was reported that the hens that had additional handling (as opposed to minimal handling) faced the front of the cage and were oriented towards the front portion of the cage during a human approach test. In addition, the hens with additional handling had a six percent increase in hen egg production. Findings
supporting the influence of humans on animal productivity, both positive and negative
effects, support human-based training and education approaches to both improve welfare
and address factors of practical and monetary concern in livestock production.

**Human Attitude and Behavior Relationship**

**Formation of Attitudes**

The formation of attitudes is integral to understanding how behavior is formed. Fishbein and Ajzen (1975) described that the formation of attitudes is a process that includes a person’s life experiences that will determine what that person believes about events, objects or people. These beliefs are made of past experiences as well as inferences. Attitudes are not static over time, but in fact have the possibility to change over time. This is one fact that creates difficulty when trying to measure attitudes. In addition, attitude is a hypothetical construct that cannot be directly observed and must be inferred from other responses that can be measured.

**Measurement of Attitudes**

There are many variables that create a person’s behavior. To understand how the variables interact to determine the behavior, one must look at the variables individually. The components that are used in questions to determine attitude include cognition, affect, and conation (Ajzen, 1988). Cognitive responses reflect a person’s beliefs about an object. For instance, a person who believes that gaining a college education is too expensive, does not provide quality teaching, or is a waste of time, probably would be considered to have a negative attitude towards gaining a college education. On the other hand, a person who believes that gaining a college education is a good monetary value,
creates lifelong friendships, and leads to a better career, likely would have a positive attitude toward the goal. A person’s affect is determined by their emotional response to the object. For instance, if a person has a negative viewpoint of an object they may express disdain or disgust for the object. Finally, conation involves the person’s behavioral tendency for the object. Thus, if a person has a negative attitude towards gaining a college education, they may not want to visit or attend a college, or would not want family members to visit or attend college. When creating an instrument to elucidate attitudes, these constructs need to be kept in mind.

**Theory of Reasoned Action**

The theory of reasoned action takes into account a person’s attitude toward an act or behavior and also the subjective norm (Figure 8). To more easily understand why people behave in certain ways, perhaps it is easier to work back to learn what determines behavior (behavioral intentions), and what determines behavioral intentions and attitude toward the behavior and subjective norms.

![Figure 8. Theory of Reasoned Action (Ajzen, 1988)](image)

Behavior, for the most part, is under a person’s volitional control, meaning that they can choose to perform, or not perform, a behavior (Ajzen, 1988). This creates what
is considered a willful behavior, meaning that the occurrence of the behavior is a direct
effect of deliberate attempts made by an individual. The person is using intent to engage
in a behavior, thus the term behavioral intention. This is the best predictor of a person’s
behavior because it is expected that a person will do what they intend to do (Ajzen,
1988). However, being able to predict behavior from a person’s intentions does not
provide detailed information about why the person is performing the behavior. In this
case, the determinants of the behavioral intentions must be identified. Ajzen and
Fishbein’s (1975) theory of reasoned action is concerned with the antecedents of the
behavior. This theory is based on the assumptions that people will behave in a sensible
manner, and that a person’s intention to complete a behavior is an immediate determining
factor of the behavior being performed.

Intentions are made of two constructs, attitudes and subjective norms. The
information about attitudes was described earlier. Subjective norms are the person’s
perception of social pressure to perform or not perform a specific behavior (Ajzen, 1988).
A person will perform a behavior if they consider that it is positive and that others believe
that it should (or should not) be performed. Basically, it is performing behavior that a
person, as well as society would consider appropriate. Although attitudes and subjective
norms are both part of the behavioral intentions, they may contribute different amounts.
For instance, the decision for a couple to give a baby up for adoption may be more
strongly affected by perceived social pressures than the decision of what breed of dog to
buy.

One of the most important factors in the theory of reasoned action is the person’s
volitional control. However, there are times when a person’s ability to perform a behavior
is affected by extraneous factors including: skills and abilities, knowledge, emotions, opportunity, and dependence on others. These factors may prevent a person from performing a chosen behavior, even if they have the behavioral intention to do so (Fishbein and Ajzen, 1975).

**Theory of Planned Behavior**

The theory of planned behavior builds upon the theory of reasoned action but adds a third construct, which is perceived behavioral control (Figure 9). Ajzen (1988) refers to perceived behavioral control as, “the perceived ease or difficulty of performing the behavior and it is assumed to reflect past experiences as well as anticipated impediments and obstacles.” This final construct emphasizes the person’s perceived behavioral control, not necessarily the person’s true behavioral control.

At its most basic level behavior is made of beliefs that are relative to the behavior, which are behavioral, normative, and control beliefs. Behavioral beliefs influence attitudes towards behavior, normative beliefs create the basis of subjective norms, and control beliefs comprise the grounds for perceptions of behavioral control. All three constructs are active when a person is calculating an intention that will lead to a behavior.
Determining why a person behaves in a certain way can be complex, however with the correct tools, it can be done. Observation of the human and questionnaires that target their attitudes and beliefs are common tools that are utilized. In the dairy industry, it has been found that stockperson attitude can be an important factor in determining the behavior that a stockperson will have (Breuer et al., 2000). Hemsworth et al. (1989) found that attitude variables were also an indicator of the fear level of sows. When the stockpeople had a negative belief of the sows and/or their job, the sow’s fear (as measured by avoidance testing) was greater and the reproductive success suffered. This research led to the idea that there is potential to reduce fear in sows if the attitudes and behavior of the workers were targeted for improvement. Hemsworth and Coleman (1998) proposed a model of how the attitudes of the stockperson can affect the productivity and welfare of livestock animals (Figure 10).
Figure 10 represents the interactions that the stockperson has with pigs and that the animals in turn have with the stockperson. A person’s attitudes about pigs lead to their behavior toward pigs, which determines the pig’s fear levels of the human, which ultimately determines the productivity and welfare of the pigs. Pig fear levels can help to establish the attitudes that a stockperson has about pigs. For instance, if a stockperson had a negative attitude about pigs, their behavior would likely to be negative as well. The negative behavior would be likely to increase pig fear levels, which could make them
more difficult to handle, which could reinforce the negative attitudes that the stockperson had about pigs.

A stockperson’s attitude about their job can also affect many non-animal related factors. A stockperson’s attitude can be part of what determines their motivation to learn, which affects their technical skills and knowledge, which affects their work performance, which finally affects the pigs’ welfare and productivity. For example, a stockperson with a positive attitude about their job would be more likely to have a higher motivation to learn, which could increase their skills and knowledge, which would increase their work performance, which would finally improve the welfare and productivity of the pigs.

**Changing stockperson attitudes and behavior**

With the factors from Figure 10 being recognized, research was then completed to predict stockperson behavior and how to modify it (Hemsworth and Coleman, 1998). Coleman et al. (2000) studied the effectiveness of using a training program to improve stockperson attitude and behavior. The program was successful and the results showed that the pig’s withdrawal behavior was reduced after the stockpersons completed the training program. Also, interestingly, the retention rate for the workers that completed the program was 61% as opposed to those that did not participate in the program (47%), a 29% increase in retention rate. Training helped decrease worker turnover, which may result in reduced monetary and time expenditures dedicated to identifying, hiring, and training new personnel. Results of the study clearly showed also that a stockperson’s attitude and behavior could be changed with a training program. Taking previous research a step further, Hemsworth et al. (1994a; 2002) extended the training program to be tested on swine and dairy farms, respectively. Building on the evidence that a
stockperson’s attitudes and behavior can be changed, Hemsworth et al. (1994a) began to study the influence of attitudinal and behavioral changes on production variables on commercial swine farms. Following training, farms where stockpersons received training farrowed 23.8 pigs/sow/year, a 7.2% increase with no additional input costs, when compared with productivity of sows on farms where no training was conducted (22.2 pigs/sow/year). A seven-percentage point improvement in productivity, in particular in relation to mean US productivity level (24 pigs/sow/year estimated, unpublished analysis of available data resources) has a tremendous influence on weaned pig cost and profit potential. However, of additional interest is the need for study of productivity in swine breeding herds achieving over 30 pigs/sow/year, where a marginal increase of seven percent would be much more difficult to achieve, but where an incremental increase still has value.

In a similar approach, this training program was implemented and studied in the dairy industry, where results revealed that reducing negative behaviors and fear levels in cows when measured over two lactations, were associated with a significantly increased farm milk yield (Hemsworth et al., 2002). Combined, these research studies verify that both swine and dairy training programs can assist in the facilitation of changes in stockperson attitude and behavior. The changes are beneficial for many reasons. First, the change in stockperson attitude and behavior means that the welfare of the animals will improve because stockpersons will be handling and treating the animals with better welfare practices. These positive changes in animal welfare and treatment of the animals by the stockpersons then translate into improved production characteristics from the animal. The combination of the improvement in welfare and the improvement in
productivity can have a direct effect on the overall economic success and profitability of a farm business.
REFERENCES


Hemsworth, P. H., Barnett, J. L., Coleman, G. J., and C. Hansen. 1989. A study of the relationships between the attitudinal and behavioral profiles of stockpersons and


Morrison, R. S., L. J. Johnston, A. D. Hilbrands. 2007. The behavior, welfare, growth performance and meat quality of pigs housed in a deep-litter, large group housing system compared to a conventional confinement system. Applied Animal Behavior Science. 103: 12-24


CHAPTER 2: EVALUATION OF OHIO CONTRACT PRODUCTION STOCKPERSON DEMOGRAPHICS, WORK HABITS, AND ATTITUDES AND BEHAVIOR TOWARD PIGS AND THE SUBSEQUENT EFFECTS ON PIG BEHAVIOR AND CORTISOL CONCENTRATIONS

ABSTRACT

Contract finishing facilities (n = 32) representing two integrated swine contractor systems within Ohio were observed to characterize the demographics (through a questionnaire) and study daily work habits of the stockpersons (n = 40) working on the farms. In addition, saliva samples were collected for cortisol concentration analysis, the mean time needed to gather the saliva samples was recorded, and video-recorded stroll tests were completed. Finally, three questionnaires were completed by stockpersons to determine stockperson attitudes about pigs and also about working with pigs. Of the 40 persons observed, 34 completed the questionnaire. The facilities used in the research housed a minimum of 1000 pigs. Two standard observers visited each farm for two consecutive days, at a time designated by the stockpersons, to record human behaviors during the daily work.

On average, the stockpersons were 40 yrs of age (range 21 to 60 yrs), had worked with pigs for 15.5 yrs (range 1 to 40 yrs; mode = 8 yrs), and worked in contract finishing for 7.6 yrs (range 1 to 20 yrs; mode = 1 yr). Males were the predominant gender (91% male; 9% female). Thirty of the stockpersons indicated having additional employment besides contract swine production, including responses such as grain farming, dairy
farming, beef feedlot manager, electrician, and truck driver. When asked why they entered into a finishing production contract, some responses were diversification, enjoyment, income, and risk reduction. Thirty of thirty-three stockpersons had completed Pork Quality Assurance Plus® training. Seventeen of the stockpersons had completed other swine training in addition to PQA® Plus.

The mean stroll test result was 2.5 ± 0.9 pigs/frame. The mean cortisol concentration per pen was 1.3 ng/ml (confidence interval 1.2-1.3 ng/ml). The mean time to gather a saliva sample per pig was 49.6 s (confidence interval 48.7-50.5 s).

There were no differences for stroll test results or cortisol concentrations when the stockperson’s daily observation technique was accounted for (P > 0.05). The mean time taken to gather saliva samples was trended lower (P < 0.07) for pigs whose stockperson entered the pens on one day and observed from the aisle on the other day (42.2 s, confidence interval 42.5-56.3 s) than the pigs whose stockpersons observed from the aisle on both days of observation (55.8 s, confidence interval 42.5-56.3 s). If stockpersons observed pigs from the aisle, they spent 20.1s in observation, while those that entered the pens to observe pigs spent 33.3 s in observation.

The summary results are indicative of the large variation in stockperson attributes that are observed within contract finishing facilities within the given integrated contractor and suggest that stockpersons working on the farms may need additional training to improve animal welfare. Also, the expanded knowledge of the factors that influenced variation among stockpersons can serve as an aid in determining training and education needs for contract finishing stockpersons in the future.
INTRODUCTION

The United States (U.S.) has a large swine industry that has seen substantial change over the last 50 years, with a decrease in the number of operations raising swine coupled with an increase in the number of swine at each operation. In 1961, the U.S. marketed over 74 million hogs for a total of 13 million pounds of pork compared to 113 million hogs in 2009 for a total of 23 million pounds of pork produced (USDA, 2009).

In 1961, there were more than 1 million operations that raised swine and by 2010 there were approximately 65,000 operations that raised swine (USDA, 2010). When the numbers of operations are divided into smaller groupings, vast differences among the groups can be seen. The total number of operations marketing between 1-99 hogs per year was just over 50,000, whereas the total number of operations marketing more than 50,000 hogs per year is approximately 132. However, the operations that market more than 50,000 hogs per year control over 56% of the total U.S. swine inventory (Grimes and Lawrence, 2007).

These changes have been made because of advances in housing systems and production science. In the middle of the 20th century pigs were housed in extensive systems that were often outdoors using sow huts. Many farms would have had enough animals to feed their family and perhaps sell some at a market. With the progression of indoor, pen housing, more pigs are often be kept in the same or smaller rearing area, thus focusing and often reducing labor needs, while increasing capital expenditures, but also
moving a greater proportion of production through off-farm market channels.

In the U.S. swine industry, the total number of hogs produced under contract increased from 30% in 1997 to 46% in 2006 (Lawrence and Grimes, 2007). Production contracts have made it possible for operations to grow in size and scale because the company that owns the animals is able to increase total pig numbers without an increase in capital expenditures. The increase in the total number of pigs owned by an operation created the need for more stockpersons to raise the pigs. A production contract is unique as it specifies in detail the production inputs supplied by the contractor (processor, feed mill, other farm operation or business), the quality and quantity of a particular commodity, in this case pigs, and the type of compensation to the grower (contractee) for services rendered (USDA, 2011). Because of the changes in the swine industry, many stockpersons may have decided to forego caring for sows and raising weanling pigs at their own operations and decided to become a contract stockperson instead. The contract stockpersons provide the fixed cost items at their operation and the contract marketing company provides the pigs, feed, medicine, market access, and management (USDA, 2011).

The increase in the total number of hogs produced under contract also means that stockpersons have been recruited to raise pigs from either weaning age or as feeder pigs until market. Contract companies that raise between 50,000 and 500,000 hogs search for stockpersons that do not necessarily have experience raising swine, but are willing to train the stockpersons (Lawrence and Grimes, 2007).

Little, if any, information about the demographics, work habits, attitudes, and behaviors of stockpersons that raise pigs under a production contract in Ohio has been
published. This research aims to understand the demographics of the stockpersons, determine the type and level of professional swine training they have completed, identify other employment being undertaken besides raising pigs, detail their reasons for raising pigs under a production contract, and to characterize the manner that contract producers observe their pigs as the combination of these factors relate to the individual and interactive effects of pig welfare and stockperson attributes. We hypothesize that the study will identify specific attributes of contract growers that contribute to variation in observed measures of pig welfare and outline specific areas where additional training is needed to improve pig welfare.
MATERIALS AND METHODS

Subjects

A total of 32 swine facilities were visited, representing two established pork contractor systems (Contractor A and B) within Ohio. Each contractor provided access to 16 wean-to-finish or feed-to-finish contract grower facilities, with ‘barns’ or ‘rooms’ that had a capacity ranging from 400 to 1200 pigs. Facilities generally contained market pigs, but a sub-sample of 6 facilities from contractor A also marketed replacement gilts at various time points along the pig’s growth cycle.

Each facility was visited on two consecutive days with pigs at a target age range of 10 to 14 weeks of age. For biosecurity, blocking, and pig flow reasons, visits were rotated between contractors monthly. Within a contractor, a maximum of two sites per week were visited and eight total facilities visited in a four-week period, followed by a one-week break and then testing of eight facilities within the second contractor was completed.

Each contractor’s management group was provided details of the research and collaboration agreements were established to allow access to stockpersons and their facilities and for use of relevant production data (when available). All stockpersons were told the objective of the research was to investigate human and pig interactions. Details of the proposed treatment were not discussed to avoid interference or challenges with the validity of the observations and the effectiveness of comparisons with the control treatment. At the end of the research, all stockpersons were provided full details of the
research and the results, and were given an opportunity to confidentially discuss with the researchers their individual results as described in protocols established by Hemsworth et al. (1994).

Within a contractor, meal-form diets and sequence of the diet changes were the same for all tested facilities. Pigs were provided ad libitum access to feed and water. Within a contractor, pig genetics were similar in breed composition, or nearly in similar proportions if multiple genetic lines were present within facilities. Pre-weaning and nursery facility handling were similar within a contractor. In wean-to-finish facilities, pigs were generally double-stocked up to 7 or 8 weeks of age and then split. Pigs from nursery facilities entered the finisher at 7 to 8 weeks of age. During the finishing stage, pigs were provided an industry standard 7.4 to 8.0 ft\(^2\) per pig. All facilities had fully slotted floors and were mechanically ventilated. Each contractor provided Standard Operating Procedures (SOPs) to each stockperson and mandated its own training program for the stockpersons.

**Behavior of the Stockperson**

Stockperson behavior observations were made during the stockperson’s normal, daily time for observation of the pigs on two consecutive days. Observations were collected only within the facility and included all tactile actions, auditory actions, and related pen activities performed, including, but not limited to, daily facility maintenance, entry into pens, and health checks.

Two experimenters followed the stockperson’s daily walk-through at a distance of 5 to 15 m from the stockperson. One experimenter recorded all human auditory observations while the other experimenter used a video camera to record the
stockperson’s tactile interactions and pen activities. Video footage was analyzed to
determine the type and frequency of tactile interactions and pen activities. If there was
more than one primary stockperson the observers followed the first stockperson on d 1
and the second stockperson on d 2.

**Analysis of Stockperson Observations**

Auditory behaviors were grouped into 1) mouth sounds (TW) such as talking,
whistling or other mouth sounds (e.g. clicking or kissing sounds), and 2) hand sounds
(HER) such as clapping or slapping one’s hand on a leg (H), hitting equipment with a
body part or tool (E), and using a tool that created a rattling sound (R). The variable
ALLAUDITORY was calculated and is the sum of TW and HER.

Tactile interactions recorded were classified using the method from Hemsworth et
al. (1994). Positive (P) behaviors included patting or stroking, neutral (NEU) behaviors
included tapping and standing in the pen, and negative (ALLNEG) behaviors included
slaps, hitting and kicking. The ALLNEG category was sub-divided into tactile actions
that were moderately negative (MNEG) and included slaps and forceful pushes and very
negative (VNEG) that included hits and kicks. The variable ALLTACTILE was
calculated and is the sum of P, NEU, MNEG, and VNEG. The frequencies of all
behaviors were measured in 5 s bout intervals. For instance, a behavior lasting 4 s would
be counted as occurring once; a behavior that lasted 12 s would be counted as occurring
three times (Edwards, 2007).

**Units of Measurement**

The frequency of auditory and tactile interactions was standardized to account for
the number of pens in a given facility. Standardization included totaling the number of
behaviors performed by the stockperson for the day and dividing the total by the number of pens in the stockperson’s facility, allowing reporting of results as the number of observations per pen (Edwards, 2007).

**Location of Pig Observation**

During the daily observation of pigs in their facilities, stockpersons either entered the pens to move throughout the pigs or stayed in the aisle and observed the pigs. This was recorded on both observation days. Categories of stockperson entry were created: if the stockperson entered pens on both days (PEN), if the stockperson entered pens one day and observed from the aisle on the other day (BOTH), and if the stockperson observed from the aisle on both days (AISLE).

**Behavioral Response of Pigs to Humans**

A stroll test similar to Cransberg (2000) was used to assess the pigs’ approach or avoidance from a non-familiar human. On day 1, half of the pens were given the stroll test. On visit day 2, the remaining pens (those not given the stroll test on day 1) were given the stroll test. Before the commencement of the stroll test, the experimenter walked the length of the aisle of the facility to alert the pigs of the experimenter’s presence. A video camera was mounted on a tripod and held in a standard, stationary position to capture a view of the area in front of the experimenter (1 m × 0.6 m). The experimenter entered at the aisle-way corner of the pen, and moved at the pace of one step per second around the pen following a designated path as shown in Figure 1; 1) from the front to the back of the pen, 2) turned and walked across the back of the pen, 3) turned and walked from the back to the front, 4) turned and walked diagonally to the back of the pen, 5) turned and walked across the back of the pen, and 6) diagonally crossed to the front
corner of the pen. The video was analyzed and the number of pigs in the field of view of the camera was counted at 5 s intervals in each pen, and the average number reported as STROLL.

![Stroll Test Path Diagram](image)

**Figure 11. Stroll Test Path**

**Saliva Collection**

To gather saliva from pigs to determine cortisol concentrations (CORT), a Salivette® (Sarstedt, Inc., Newton, N. C.) was attached to the end of a 1.5 m length of polyvinyl chloride (PVC) pipe using 16-gauge wire to extend the Salivette® to the randomly targeted focal pig. The focal pig was allowed to chew on the Salivette® until it was thoroughly moistened (2-min max) and the time to collect the sample was recorded (TIME). If the Salivette® was not sufficiently moistened at 2 min, a new pig (same
Salivette®) was sampled in a similar area of the pen. In pens with 35 or fewer pigs, two pigs were sampled (one in the front and back of the pen, respectively). In pens with greater than 35 pigs, three pigs were sampled (one in the front, middle, and back of the pen, respectively). Saliva samples were collected from one half of the pens (the opposite of the pens that were given the stroll test). The second half of the pens had saliva samples collected on day 2, again opposite of the pens that were given the stroll test.

Salivettes® were centrifuged for 15 min at 3000 rpm and within pen samples equally aliquoted to form a single test sample for each pen. Pen samples were stored at -10 F in a freezer until analysis. Samples were assayed for salivary cortisol using a highly sensitive enzyme immunoassay (Salimetrics, State College, PA). The test used 25 µL of saliva per determination, has a lower limit of sensitivity of 0.003 µg/dL, standard curve range from 0.012 µg/dL to 3.0 µg/dL, an average intra-assay coefficient of variation of 3.5%, and an average inter-assay coefficient of variation of 5.1%. Method accuracy determined by spike and recovery averaged 100.8% and linearity determined by serial dilution averaged 91.7%.

**Stockperson Attitude Measurements**

Four questionnaires were provided to the stockpersons after the initial visit to the facility. Three questionnaires were created specifically for this research and one was created previously for the ProHand program (Hemsworth et al. 1994a). The questionnaires were either mailed or hand-delivered to the stockpersons. Responses to the questionnaire were prefaced by stating in oral or written form that, “As a stockperson with experience working with pigs, your input on the questionnaire is valuable. The
information you provide, along with the observations collected in your facility, is valuable to the experiment and interpretation of future findings”.

The questionnaires were designed to assess three areas; 1) working with pigs, 2) attitudes about pigs, and 3) demographic information to further characterize the stockpersons. The questionnaire titles and subscales are listed below.

**ProHand Questionnaire:**
For all statements a five-point likert scale from strongly disagree to strongly agree was used. All responses were changed in order to make a higher number indicate a more favorable answer.
1. Positive attitude towards pigs
2. Pigs are easy to work with
3. Characteristics of pigs
4. Pigs make good pets

**Stockperson Perceived Behavioral Control and Attitude Towards the Behavior Questionnaire:**
For all statements a five-point likert scale from strongly disagree to strongly agree was used. All responses were changed in order to make a higher number indicate a more favorable answer.
1. Time spent with pigs at a young age
2. Making a priority to manage pigs
3. Banging on equipment to rouse pigs during daily walkthrough
4. Beliefs about patting of pigs
5. Beliefs about talking to pigs
6. Attitude about using stockboards during medicating and daily walkthroughs
7. Working quietly during market hog loadout
8. Tool use during market hog loadout
9. Use of electric prods during market hog loadout
10. Use of tools, kicks, hits to get pigs up
11. Walking in the pens with pigs is good

**Stockperson Attitudes About Pigs Questionnaire:**
For all statements a five-point likert scale from strongly disagree to strongly agree was used. All responses were changed in order to make a higher number indicate a more favorable response.
1. Physical and verbal effort required to move pigs
2. Beliefs about ease of loading hogs for market
3. Loading pigs for market is a pleasant experience
4. Pigs need enrichment
5. Positive attitude about pigs
6. Human behavior affects pigs
7. Hogs are harder to handle and load when fed Paylean®

Demographics Questionnaire:
For the demographics questionnaire, the stockpersons were asked to indicate the correct response on the form and write in any answers that are open-ended
1. Sex: M   F
2. Age
3. Highest Education Level Completed (check highest level of education)
   -Less than high school
   -High school diploma
   -Trade/vocational program
   -Some college
   -Bachelor’s/Associate's degree
   -Graduate or Professional degree
      If so, what degree:
4. Years experience working with pigs
5. Years working as a contract grower
6. Job besides contract growing (example: grain farmer, school teacher)
   -If farming besides contract growing, list type and size of production (example: 1500 acres of grain farming, 100 head cow/calf operation)
7. Reason for contract growing pigs
8. Number of people that work on your contract grower farm: (circle correct number of workers) 1 2 3 4 5 Greater than 5, if so, how many
9. Training that you have had for pig production: (check all that apply)
   -PQA® Plus
   -Transportation Quality Assurance® (also called Trucker Quality Assurance)
   -Courses in high school (example: vocational agriculture class)
   -Courses at a university
   -Other: Please specify

Stockperson Log

Stockpersons were asked to complete a log sheet at each facility for a period of one week after the visit. The log sheet was used to record the time spent in the facility for each person entering, time involved in adjusting water and feed equipment, documentation of how long they spent in pens and aisles, time spent managing health, mortality, and other ‘abnormal’ occurrences.

Statistical Analysis
Demographic information was analyzed using the frequency procedure in SAS (v9.2; Cary, N.C). For all analyses, cortisol concentration, average time to gather a saliva sample, and the stockperson time per pen were transformed using a $\log_{10}$ transformation. For reporting, means were back-transformed and confidence intervals were calculated and back-transformed.

Dependent measures of stockperson tactile and auditory interactions, pen activities, pig measurements, and stockperson daily observation location were analyzed using the mixed procedure of SAS. Models for tactile and auditory actions and pen activities included fixed effects of Contractor (A and B) and Training (Training/No-Training) and the random effects of Day of Observation (1 or 2) and the interaction of Facility x Contractor. The model for stockperson daily observation location included a fixed effect of observation location (AISLE, PEN, BOTH) and a random effect of Facility x Contractor.

Questionnaire descriptive statistics were summarized using the means procedure in SAS. Relationships within and across questionnaires [1. Stockperson attitudes and beliefs about working in the Pork Industry (from ProHand Pigs, 2011), 2. Stockperson attitudes and beliefs about working with pigs in their barn, and 3. Stockperson attitudes and beliefs about pigs and their characteristics] were analyzed using the correlation procedure in SAS. All questionnaire subscales were analyzed within and across all questionnaires.
RESULTS

Demographic Information

Age and Gender

Thirty-four of the 40 stockpersons completed the demographic questionnaire. The means and standard deviations for the variables are presented in Table 1. For those completing the questionnaire, the mean age of the stockpersons was 40 yrs, with a range of 21 to 60 yrs. The percentage of male stockpersons was 91% and the percentage of female stockpersons was 9%.

Training and Education

The number of stockpersons in each training and education category is listed in Table 1. Thirty-three of the 40 stockpersons answered how much education they had completed. The stockperson education level varied: three had less than a high school diploma, 12 had a high school diploma, four had some college, seven had completed a trade/vocational degree, and seven had an associate’s or bachelor’s degree. Of the 34 respondents, 30 had Pork Quality Assurance Plus Training (PQA®). One stockperson completed courses in high school only. Three of the stockpersons had no swine management training. Twelve stockpersons had both PQA® training and high school courses in swine management. Three had courses in high school and courses at a university in addition to PQA® training. Two stockpersons had PQA® training, Transportation Quality Assurance (TQA®) training, and courses in high school. One
stockperson had PQA® training, courses in high school, and livestock mortality compost training. Finally, one stockperson had PQA® training, TQA® training, courses in high school, and courses at a university.

**Experience in the Swine Industry**

On average, stockpersons had worked with pigs for 15 yrs, ranging from 1 to 40 yrs. The mean experience as a contract producer was 8 yrs with a range of 1 to 20 yrs. Six stockpersons had just one year of contract producing experience and one had 20 yrs of experience. When examining the interaction between the years of pig experience versus the years working as a contract producer, there were 10 stockpersons that had equal numbers of years of pig and contract producing experience. Three stockpersons had been working with pigs and working as a contract producer for one year.

Stockpersons were posed the open-ended question, “Why do you raise pigs under contract?” The greatest numbers of responses were: “income” (n = 8) and “market stability” (n = 6). There were three responses for each of the following: “to diversify”, “I enjoy it”, and “I like pigs”. “To work with family”, “it’s a job”, “I retired from dairy”, “it works well”, and “to get manure” each had two responses. Finally, there was one response each for “something to do”, “an investment”, and “to start a business”. The two stockpersons who responded “to get manure”, also stated that they wanted “income” or an “investment”. When the stockpersons’ top responses were further classified, 22 stated that they raised pigs for financial reasons and nine cited reasons that revolved more around working with family, livestock, or because they enjoy working with pigs.

Thirty-two of the 34 stockpersons answered that they had employment besides working as a contract grower. Seventeen stockpersons had one additional form of
employment, 10 stockpersons had two other types of employment, and five had three additional forms of employment. The types of additional employment varied. Of the 32 that had other employment, the detail of their employment were as follows: 24 grain farmers, eight raised other livestock, six tradesmen, four worked in finance, three worked in trucking, two school teachers, one sports coach, and one postal worker. Fourteen of the 15 stockpersons that had two or three additional forms of employment answered that they were grain farmers. Five stockpersons answered that they had three additional forms of employment. Jobs in allied agriculture were the additional forms of employment for all five stockpersons.

**Pig Measurements**

The descriptive statistics for CORT, TIME, and STROLL are presented in Table 2. Cortisol concentrations ranged from 0.30 ng/ml to 6.94 ng/ml and mean 1.36 ± 0.62 ng/ml. The average time needed to sample had a mean of 52.48 ± 18.91 s with a range of 15.5 to 121.50 s. Finally, for the stroll test, the mean was 2.49 ± 0.87 pigs in the frame per five seconds with a range of 0.29 to 5.17 pigs in the frame/five s.

**Stockperson Behaviors and Pig Behavior and Endocrine Measurements**

The main effects of Contractor A and B are shown in Table 3, including the least squares means and standard errors or confidence intervals. The only significant difference between Contractor A and B was pig cortisol concentrations. Across the facilities tested, Contractor A (1.43 ng/ml) pigs had greater cortisol concentrations (P < 0.05) than pigs from Contractor B (1.03 ng/ml).

**Pen Entry and Time Spent In Facility**
The least squares means and standard errors or confidence intervals for stockperson observation are in Table 4. There were 22 stockpersons that entered the pens on both days (PEN), three that entered pens on one day and observed from the aisle on the other day (BOTH), and seven stockpersons that observed from the aisle on both days (AISLE).

When observation location was calculated as a percentage of total facilities, PEN was 68.8%, BOTH was 9.4%, and AISLE was 21.9%. When stockpersons entered pens, they spent an average of 33 s/pen. If the stockperson observed from the aisleway, they spent an average of 20 s/pen. There was no significant difference (P > 0.05) when PEN, BOTH, or AISLE were analyzed in the model for CORT and STROLL.

There was a trend for the mean time to gather a saliva sample (P = 0.07), whereby the pigs at facilities where stockpersons entered the pens one day and observed from the aisle on the other was lower than pigs at facilities where stockpersons observed from the aisle on both days, but the same as pigs at facilities where the stockpersons entered the pens on both days. The mean time to gather a saliva sample from pigs at facilities where the stockpersons entered pens on both days and the pigs from facilities where the stockpersons observed from the aisle on both days was not different (P > 0.05).

**Questionnaire Subscale Responses**

Questionnaire subscale means, standard deviations, minimums, and maximums can be found in Table 5. Thirty-one stockpersons completed the ‘Stockperson attitudes and beliefs about working in the pork industry’ questionnaire (PHQ), and 33 stockpersons completed the ‘Stockperson attitudes toward working with pigs in their barn’ questionnaire (Q1) and the ‘Stockperson attitudes and beliefs toward pigs and pig
handling’ questionnaire (Q2). For PHQ, on a five-point likert scale, both ‘positive attitude toward pigs’ and ‘pigs make good pets’ had means near 3.00, which was a neutral response. For ‘like to work with pigs’ (3.23) and ‘characteristics of pigs’ (4.10), the responses were higher than three, indicating that the stockpersons were more positive in their attitudes towards working with pigs and characteristics of pigs.

For Q1, there were no variables responses near neutral (3.00) they were either higher of lower on a five-point likert scale. The highest (most agreeable) response was to the ‘using tools such as rattle paddles, sorting boards or pvc-pipes when loading hogs for market is good’ subscale at 4.39. There were no stockpersons that strongly disagreed with this statement. Another agreeable response (3.97) was to the subscale, ‘it is important to spend more time with pigs when they are young.’

There were only two subscale items that had an average below the neutral point on the likert scale. The subscale with the most mean disagreement from the stockpersons (2.02) was entitled, ‘electric prods should not be used when loading hogs for market.’ In fact, the maximum score was a 3.5 on a five-point likert scale, which is in between neutral and agree. In addition, on average, the stockpersons thought (2.71) that voices and whistling when loading hogs for market is bad.

The results from Q2 revealed that three of the subscales had means below neutral (3.00) on the five-point likert scale: 1) ‘loading pigs for market is an enjoyable task’ (2.90), 2) ‘loading pigs for market requires slow and quiet movement with minimal use of electric prods’ (2.37) and 3) ‘feeding Paylean® does not make pigs more excitable or more difficult to load for market’ (1.76). This PAYLEAN subscale had no stockpersons
respond with a four or five, which indicates that none of the stockpersons agreed or strongly agreed that Paylean® does not affect pigs.

The Q2 variable with the highest mean response was for the subscale, ‘actions towards pigs influence the pig’s behavior’ (3.92). The subscale, ‘little physical and verbal effort is needed to move pigs’ was on the agreeing side of neutral (3.20). Stockpersons felt more neutral about the subscales, ‘pigs need enrichment in their pens’ (3.12) and ‘pigs are perceived as non-destructive, liking humans, and non-aggressive toward humans’ (3.09).

**Questionnaire Subscale Correlations**

**Within Subscale Correlations**

Within questionnaire subscale correlations that were significant (P < 0.10) are presented in Tables 6 and 7. For the ‘stockperson attitudes and beliefs about working in the pork industry’ questionnaire (PHQ), ‘positive attitude toward pigs’ was positively correlated with ‘like to work with pigs’ (r = 0.61) and ‘characteristics of pigs’ (r = 0.40). ‘Characteristics of pigs’ was positively associated with ‘like to work with pigs’ (r = 0.46) and ‘pigs make good pets’ (r = 0.42).

For the ‘stockperson attitudes toward working with pigs in their barn’ questionnaire (Q1), ‘pigs find it unpleasant when a tool, a kick, or hit is used to get pigs up’ was positively associated with ‘managing pigs is a greater priority than other off-farm responsibilities’ (r = 0.35) and ‘banging and loud noises are not necessary during daily observation’ (r = 0.37). ‘Talking to pigs while in the barn is good’ was positively correlated with ‘patting pigs while in the barn is good’ (r = 0.54) and ‘electric prods should not be used when loading for market’ (r = 0.31). Finally, ‘electric prods should...
not be used when loading for market’ was positively correlated with ‘using loud noises when loading for market is bad’ (r = 0.34) and negatively correlated with ‘using sorting tools when loading for market is good’ (r = -0.33).

The ‘stockperson attitudes and beliefs toward pig and pig handling’ questionnaire (Q2) only had one significant correlation and it was between ‘actions toward pigs influence the pig’s behavior’ and the subscale, ‘loading hogs for market is a pleasant experience’ (r = 0.44).

**Across Questionnaire Correlations**

Across questionnaire subscale correlations that were significant (P < 0.10) are presented in Tables 6 and 7. There are numerous associations when studying correlations among the three questionnaires (PHQ, Q1, and Q2). There were no significant (P ≥ 0.10) correlations between subscales from PHQ and Q1.

The Q2 subscale ‘pigs are perceived in a positive manner by humans’, was positively correlated with the PHQ subscale ‘positive attitude toward pigs’ (r = 0.47), ‘like to work with pigs’ (r = 0.59), and ‘pigs make good pets’ (r = 0.42). The PHQ subscale, ‘positive attitude toward pigs’ was negatively associated with ‘pigs need enrichment in their pens’ from Q2 (r = -0.45), meaning that as a stockpersons attitude toward pigs was more positive, the less likely they were to agree that pigs need enrichment items in their pens. The PHQ subscale ‘pigs make good pets’ was positively correlated with ‘loading pigs for market requires slow and quiet movement with minimal use of electric prods’ (Q2) (r = 0.31). The Q2 subscale, ‘loading hogs for market is a pleasant experience’ was positively associated with ‘like to work with pigs’ (PHQ) (r = 0.37), indicating that the stockpersons felt that pigs are easy to work with and that one
should work quietly around pigs during loadout. Finally, ‘actions toward pigs influence the pig’s behavior’ (Q2) and ‘walking through pens daily is good’ (PHQ) were positively correlated ($r = 0.29$).

The Q2 subscale, ‘little physical and verbal effort is needed to move pigs’ was positively correlated with Q1 subscales ‘using loud noises when loading for market is bad’ ($r = 0.39$), ‘electric prods should not be used when loading for market’ ($r = 0.29$), and ‘loading pigs for market requires slow and quiet movement with minimal use of electric prods’ ($r = 0.31$). ‘Banging and loud noises are not necessary during daily observation’ (Q1) was positively associated with the Q2 subscales, ‘actions toward pigs influence the pig’s behavior’ ($r = 0.58$) and ‘loading hogs for market is a pleasant experience’ ($r = 0.41$). Finally, there is a negative correlation ($r = -0.37$) between, ‘loading hogs for market is a pleasant experience’ and ‘electric prods should not be used when loading for market’. This indicates that stockpersons that feel that loading hogs for market is a pleasant experience believe that an electric prod is needed when loading hogs for market.
DISCUSSION

Demographic differences were found among stockpersons. When the data were analyzed, it showed that the average stockperson was a 40-year-old male that has at least a high school diploma, had completed at least PQA® Plus training, and had at least one other form of employment besides raising pigs. In addition, the average stockperson worked with pigs for 15 years, and raised pigs under a production contract for more than 7 years, doing so for income. Finally, a majority of stockpersons entered their pens daily to observe pigs. However, a large percentage of stockpersons never entered pens and only observed pigs from the aisle. Stockpersons entering the pens daily may acclimate the pigs to human presence and therefore it may not be fear-provoking when a human entered the pen at loadout. Anecdotally, some stockpersons believed that entering pens daily was too stressful for the pigs, while there were others that explained that they did not enter pens daily because they did not have enough time or did not believe that they needed to enter pens because it would not affect the pens in a positive manner.

Envisioning the average stockperson is important in order for the industry and academia to understand who they are serving and providing better guidance. Understanding who target stockpersons are is important, but what might be more interesting are those who are outside of the averages, and what can be learned from them. For instance, a stockperson that has just started working with pigs and raising pigs under a production contract may have different training needs than a stockperson with greater
experience. Differences in the amount and type training were observed and there could be a concern as to why the stockpersons did not have more training than PQA® Plus. The work of Hemsworth and Coleman (1998) showed that job satisfaction and work motivation are factors that determine a stockperson’s motivation to learn, technical skills and knowledge, and work performance, which can ultimately affect pig productivity, welfare, and behavior. There is then feedback from the pigs in the same areas of pig productivity, welfare and behavior, to stockperson attitudes and behavior, job satisfaction, work motivations, motivation to learn, technical skills and knowledge, and work performance. A greater understanding of job satisfaction could help increase the stockperson’s desire to complete more swine training. Furthermore, having knowledge of the stockperson’s work motivation, again, can be finally linked to pig production and welfare. It should be further examined if the differences in work motivation (responses to the open-ended question of, “why do you raise pigs under contract?”), create any differences in how the pigs are handled by the stockpersons, which in-turn, can affect production variables and welfare (Hemsworth and Coleman, 1998).

With regard to the differences in education levels and demographics, Coleman (2008) detailed that no data exists that linked differences in the aforementioned variables to production. He stated that most of the skill used in animal husbandry do not require a high level of education, but instead conscientiousness, sensitivity, and persistence. Therefore, the educational and demographic differences observed in the current stockpersons may not have an effect on the production and welfare of the pigs under their care. However, this may not be the same for the effect of training (e.g. PQA® Plus or TQA® training). Coleman (2001) did find positive correlations between technical
knowledge and empathy attribution (the belief that animals are like humans). This relationship could mean that the stockperson believes that pigs do have feelings (e.g. pain, discomfort in high and low temperatures, fear, etc.) and therefore may treat them in a way that would most likely ameliorate those feelings should they arise. This could have an overall effect on the welfare of the pigs. This leads to the conclusion that stockperson training is beneficial to the pigs under their care.

The questionnaire results reveal some strongly held stockperson beliefs and attitudes. Interestingly, the only subscales that had a mean score lower than neutral on the five-point likert scale were those that dealt with the subject of loading hogs for market. Those subscales were: 1) loading pigs for market is a pleasant experience, 2) loading pigs for market requires slow and quiet movement with minimal use of electric prods, 3) feeding of Paylean® does not make pigs more excitable or more difficult to load for market, 4) using a loud voice or whistling when loading hogs for market is bad, and 5) electric prods should not be used when loading hogs for market. The current research did not observe stockpersons at loadout due to constraints of budget. However, these are important results because loading pigs for market is a vital task at swine facilities. More information would need to be gleaned from the stockpersons with regard to why they have the attitudes and beliefs that they do about loading hogs for market. Perhaps it is similar to what Hemsworth and Coleman (1998) described with the feedback loop, where stockperson beliefs and attitudes about pigs determine their behavior toward the pigs, which determines the fear level and welfare of the pigs. If a stockperson has a negative belief about loading pigs for market, that belief could lead to the use of negative handling behaviors toward the pigs, which could incite a fear response or excitement in pigs,
which can make them harder to handle. This, in-turn, reinforces the stockperson’s belief that loading hogs to market is an unpleasant experience. A training program for stockpersons in the swine industry was created by Hemsworth and Coleman (1994) and explains to stockpersons how their behavior affects pigs and why pigs act in the manner that they do. This training could possibly help stockpersons understand how their behavior at loadout can affect the pigs and why they act in a certain way during loadout procedures.

It is interesting that the stockpersons believe that their actions can affect the pigs (3.92), however it seems that they do not feel the same about loadout procedures as evidenced by the subscales that measured their belief about working quietly around pigs at loadout. These subscale means seem to be in direct conflict because the stockpersons believe that it is good to work and move quietly around pigs during daily observations, but during loadout it is not important to work and move quietly around pigs.

There were other correlations between subscales that measure stockpersons attitudes about loading hogs for market and other subscales. Meaning that, although the ‘loading’ subscales were less than neutral, the stockpersons that had the attitude that ‘pigs take little effort to move’ also believed that ‘one should work quietly and that electric prods are not a necessity when loading pigs for market’. In addition, stockpersons that believed that ‘one should work quietly at loadout’ also believed that ‘one should move slowly and does not require using an electric prod during loadout’. Stockpersons that were more agreeable to the statement that an electric prod is not needed during loadout also believed that stockpersons should attempt to talk to their pigs and that tools (besides an electric prod) should be used during loadout.
There were no significant differences found for CORT, STROLL, and TIME when considering the stockperson observation location (PEN, AISLE, BOTH). Cransberg (2000) performed a stroll test with chickens and found no relation between the stockperson’s time in the shed and the stroll test data. The current research investigated not the amount of time in the facility, but whether or not the stockperson entered the pens or observed from the aisle. However, these results are similar because no differences were found for the stroll test when considering the human effect on the animals. Gonyou et al. (1986) and Hemsworth et al. (1989) have specifically studied swine reactions to moving humans as characterized by Waiblinger et al. (2006). The former approached a pig and attempted to touch an approaching pig and the latter studied whether sows would withdraw from their feed when a human approached. Both experiments showed differences in the animals’ responses to the moving human; however, the research is quite different because the experimenter in the present research continually moved around the home pen. The author has no knowledge of any research that has been conducted using a stroll test in pig facilities.
IMPLICATIONS

Results of the present study provide an industry-first look at the variation in contract stockperson attitudes, beliefs, and third-party observation of behaviors toward pigs under their management. The findings support the presence of considerable differences among stockpersons in behaviors toward pigs, particularly what the authors consider a greater than necessary frequency of ‘negative’ tactile and auditory actions displayed by stockpersons on some sites. The presence of negative actions toward pigs may be, to some extent a function of experience and training related to pig production; however, based on a culmination of the questionnaire results, stockperson attitudes and beliefs play an important factor in subsequent behavior observed in the production setting and the fear responses observed in the pigs under their control. Future research efforts should concentrate on the implications of positive or negative stockperson attitudes, beliefs, and in particular, behaviors toward pigs as they associate with stockperson job satisfaction, job performance, pig welfare, and pig production measures. Industry strides toward improvement of pig welfare across all production phases are dependent on the direct contact of stockpersons with their animals. Adjustment of attitudes and beliefs and subsequent improvement of behaviors appear to be prime focal areas for enhanced education and training of swine stockpersons in Ohio and across the US.
ILLUSTRATIONS

<table>
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<tr>
<th>Quantifiable Measures</th>
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Table 1. Demographic characteristics of contract finishing swine stockpersons in Ohio sampled to assess human attitudes and behaviors.
Stroll: average number of pigs present in a video frame captured at 5 second intervals per pen;

Cortisol: salivary cortisol concentration, (minimum two pigs sampled per pen;

Cortisol time: average time required per pig to collect salivary cortisol.

Table 2. Means for descriptive statistics for measurements the interactions of pigs with a novel human observing walking in the pen, salivary cortisol concentrations, mean time to gather a saliva sample.

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<th>Pig Measurements</th>
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</tr>
<tr>
<td>Time, see$^c$</td>
<td>1474</td>
<td>49.6</td>
<td>48.7 – 50.5</td>
<td>15.5</td>
<td>121.5</td>
</tr>
</tbody>
</table>

$^a$Stroll: average number of pigs present in a video frame captured at 5 second intervals per pen;

$^b$Cortisol: salivary cortisol concentration, (minimum two pigs sampled per pen;

$^c$Cortisol time: average time required per pig to collect salivary cortisol.
<table>
<thead>
<tr>
<th>Dependent Variable&lt;sup&gt;a&lt;/sup&gt;</th>
<th>n</th>
<th>Mean</th>
<th>Contractor</th>
<th>Pooled S.E./C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tactile Actions&lt;sup&gt;d&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>1368</td>
<td>0.51</td>
<td>0.77</td>
<td>0.31</td>
</tr>
<tr>
<td>Neutral</td>
<td>1368</td>
<td>1.85</td>
<td>1.49</td>
<td>2.19</td>
</tr>
<tr>
<td>Moderately Negative</td>
<td>1368</td>
<td>1.07</td>
<td>0.85</td>
<td>1.26</td>
</tr>
<tr>
<td>Very Negative</td>
<td>1368</td>
<td>0.71</td>
<td>0.58</td>
<td>0.97</td>
</tr>
<tr>
<td>Total Negative</td>
<td>1368</td>
<td>1.79</td>
<td>1.43</td>
<td>2.18</td>
</tr>
<tr>
<td>Total Tactile</td>
<td>1368</td>
<td>4.15</td>
<td>3.67</td>
<td>4.70</td>
</tr>
<tr>
<td><strong>Auditory Actions&lt;sup&gt;d&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talk and Whistle</td>
<td>1392</td>
<td>1.06</td>
<td>0.82</td>
<td>1.14</td>
</tr>
<tr>
<td>Clap, Hit Equipment, Rattle</td>
<td>1392</td>
<td>.50</td>
<td>0.46</td>
<td>0.36</td>
</tr>
<tr>
<td>Total Auditory</td>
<td>1392</td>
<td>1.56</td>
<td>1.28</td>
<td>1.50</td>
</tr>
<tr>
<td><strong>Pen Activities&lt;sup&gt;d&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wave arms</td>
<td>1368</td>
<td>1.46</td>
<td>1.29</td>
<td>1.53</td>
</tr>
<tr>
<td>Use of Sort Board</td>
<td>1368</td>
<td>0.02</td>
<td>0.03</td>
<td>0.10</td>
</tr>
<tr>
<td>Adjust Equipment</td>
<td>1368</td>
<td>0.50</td>
<td>0.45</td>
<td>0.59</td>
</tr>
<tr>
<td><strong>Stockperson Time/pen, sec</strong></td>
<td>1368</td>
<td>33.19</td>
<td>34.8</td>
<td>33.1</td>
</tr>
<tr>
<td><strong>Pig Measurements</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cortisol, ng/ml</td>
<td>1603</td>
<td>1.25</td>
<td>1.43&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.03&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cortisol time, sec</td>
<td>1474</td>
<td>49.57</td>
<td>48.6</td>
<td>50.2</td>
</tr>
<tr>
<td>Stroll, # pigs</td>
<td>1597</td>
<td>2.52</td>
<td>2.63</td>
<td>2.39</td>
</tr>
<tr>
<td>Time of Day, hh:mm</td>
<td>1624</td>
<td>11:53</td>
<td>11:21</td>
<td>12:40</td>
</tr>
</tbody>
</table>

<sup>a</sup> Positive: patting or stroking pigs; Neutral: tapping pigs or standing in the pen; Moderately Negative: slaps and forceful pushes on pigs; Very Negative: hitting and kicking pigs; Total Negative: sum of Moderately and Very Negative; Total Tactile: sum of all tactile actions; Total Auditory: sum of all auditory actions; Cortisol: salivary cortisol concentration, (minimum two pigs sampled per pen); Cortisol time: average time required per pig to collect salivary cortisol; Stroll: average number of pigs present in a video, frame captured at 5 second intervals, per pen; Time of Day: average time of day cortisol samples were collected.

<sup>b</sup> Frequency of actions or activities per pen

<sup>bc</sup> Means in a row without a common superscript differ (P < 0.05)

<sup>d</sup> Frequency of actions or activities observed per pen

Table 3. Main effect of Contractor (A and B) on stockperson tactile and auditory actions during daily pig observation and subsequent measures of pig responses to an unfamiliar human.
Table 4. Effect of stockperson daily pig observation technique on pig measures of salivary cortisol, average number of pigs observed in a standardized video recorded time interval, and the time required per pig to collect salivary cortisol samples.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Grand Mean</th>
<th>S.D./C.I.</th>
<th>AISLE</th>
<th>BOTH</th>
<th>PEN</th>
<th>S.E.</th>
<th>C.I.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroll, # pigs</td>
<td>1058</td>
<td>2.49</td>
<td>0.87</td>
<td>2.26</td>
<td>2.28</td>
<td>2.58</td>
<td>0.23</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>Cortisol, ng/ml</td>
<td>1059</td>
<td>1.25</td>
<td>1.22-1.28</td>
<td>1.08</td>
<td>1.19</td>
<td>1.25</td>
<td>0.95</td>
<td>1.45</td>
<td>0.56</td>
</tr>
<tr>
<td>Time, sec</td>
<td>971</td>
<td>49.1</td>
<td>48.1-50.4</td>
<td>55.8</td>
<td>42.2</td>
<td>49.7</td>
<td>1.08</td>
<td>1.25</td>
<td>0.07</td>
</tr>
<tr>
<td>Stockperson: time/pen, sec</td>
<td>2483</td>
<td>31.8</td>
<td>31.0-32.7</td>
<td>20.1</td>
<td>21.1</td>
<td>21.7</td>
<td>&lt;0.0001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

aAISLE: producer views pigs daily from the aisle only; Both: producer enters and views pigs from the aisle on one but not both days of observation; PEN: producer enters each pen daily to view pigs.

b Stroll: number of pigs present in a video frame at 5 second intervals for each pen sampled; Cortisol – salivary cortisol level, min two pigs per pen; Time: time required per pig to collect salivary cortisol.
aResponses on a 5-point likert scale: Subscale: 1 = Strongly Disagree with the statement, 3 = Neutral response to the statement, = Strongly Agree with the statement  

bCategories are the mean of one to six statements in predesignated focal areas.  
Pigs are not gluttonous, dirty, smelly, greedy, ugly or stubborn’  
‘Pigs are friendly, quite, and easy to work with’  
‘Pigs are intelligent, require respect, feel pain like humans, and are excitable when moved forcefully’  
‘Pigs are fun-loving, not simple-minded, and make good pets’  

<table>
<thead>
<tr>
<th>Stockperson attitudes and beliefs about working in the Pork Industry, (from ProHand Pigs, 2011)</th>
<th>n</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Pigs are not gluttonous, dirty, smelly, greedy, ugly or stubborn’</td>
<td>31</td>
<td>3.04</td>
<td>0.53</td>
<td>2</td>
<td>4.5</td>
</tr>
<tr>
<td>‘Pigs are friendly, quite, and easy to work with’</td>
<td>31</td>
<td>3.23</td>
<td>0.54</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>‘Pigs are intelligent, require respect, feel pain like humans, and are excitable when moved forcefully’</td>
<td>31</td>
<td>4.10</td>
<td>0.60</td>
<td>2.75</td>
<td>5</td>
</tr>
<tr>
<td>‘Pigs are fun-loving, not simple-minded, and make good pets’</td>
<td>31</td>
<td>3.01</td>
<td>0.61</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

| Stockperson attitudes and beliefs about pigs and their characteristics |  
|---|---|---|---|---|---|  
| ‘Little physical and verbal effort is needed to move pigs’ | 33 | 3.20 | 0.65 | 2 | 4.33 |  
| ‘Loading pigs for market is a pleasant experience’ | 33 | 2.90 | 0.92 | 1 | 5 |  
| ‘Loading pigs for market requires slow and quiet movement with minimal use of electric prods’ | 33 | 2.37 | 0.68 | 1 | 4 |  
| ‘Pigs need enrichment in their pens’ | 33 | 3.12 | 0.65 | 2 | 4 |  
| ‘Pigs are perceived as non-destructive, liking humans, and non-aggressive toward humans’ | 33 | 3.09 | 0.54 | 2.33 | 4.67 |  
| ‘Actions toward pigs (speed of movement, entry into pens, actions within pens, and level of attention) influence the pig’s behavior’ | 33 | 3.92 | 0.68 | 2.25 | 5 |  
| ‘feeding Paylean® does not make pigs more excitable or difficult to load for market’ | 33 | 1.76 | 0.83 | 1.0 | 3.5 |  

aResponses on a 5-point likert scale: Subscale: 1 = Strongly Disagree with the statement, 3 = Neutral response to the statement, = Strongly Agree with the statement  

bCategories are the mean of one to six statements in predesignated focal areas.  
Pigs are not gluttonous, dirty, smelly, greedy, ugly or stubborn’  
‘Pigs are friendly, quite, and easy to work with’  
‘Pigs are intelligent, require respect, feel pain like humans, and are excitable when moved forcefully’  
‘Pigs are fun-loving, not simple-minded, and make good pets’  

Table 5. Mean responses for three stockperson attitude and belief questionnaires.
<table>
<thead>
<tr>
<th>Stockperson attitudes and beliefs about working with pigs under their management</th>
<th>n</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘It is important to spend more time with pigs when pigs are young’</td>
<td>33</td>
<td>3.97</td>
<td>0.90</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>‘Managing pigs is a greater priority than other farm/off-farm responsibilities’</td>
<td>33</td>
<td>3.64</td>
<td>0.64</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>‘Banging and loud noises are not necessary to rouse pigs for daily observation’</td>
<td>33</td>
<td>3.68</td>
<td>0.79</td>
<td>2.5</td>
<td>5</td>
</tr>
<tr>
<td>‘Patting pigs while in the barn is good’</td>
<td>33</td>
<td>3.55</td>
<td>0.72</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>‘Talking to pigs while in the barn is good’</td>
<td>33</td>
<td>3.70</td>
<td>0.74</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>‘Using a sorting board is necessary when moving or medicating pigs’</td>
<td>33</td>
<td>3.71</td>
<td>0.84</td>
<td>1.67</td>
<td>5</td>
</tr>
<tr>
<td>‘Using a loud voice or whistling when loading hogs for market is bad’</td>
<td>33</td>
<td>2.71</td>
<td>0.85</td>
<td>1</td>
<td>4.5</td>
</tr>
<tr>
<td>‘Using tools (rattle paddles, sorting boards, or plastic pipes) when loading hogs for market is good’</td>
<td>33</td>
<td>4.39</td>
<td>0.62</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>‘Electric prods should not be used when loading hogs for market’ subscale</td>
<td>33</td>
<td>2.02</td>
<td>0.67</td>
<td>1</td>
<td>3.5</td>
</tr>
<tr>
<td>‘Walking through pens daily is good’</td>
<td>33</td>
<td>3.62</td>
<td>0.90</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>‘When walking pens, use of a tool, a kick, or hit to get pigs up is not needed’</td>
<td>33</td>
<td>3.70</td>
<td>0.68</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

a Responses on a 5-point likert scale: Subscale: 1=Strongly Disagree with the statement, 3 = Neutral response to the statement, 5 = Strongly Agree with the statement.

b Categories are the mean of one to six statements in predesignated focal areas.

c Stockperson attitudes and beliefs about working in the pork industry, from the ProHand Pig training tool.

d Stockperson attitudes and beliefs about pigs and pig characteristics.

e Stockperson attitudes and beliefs about working with pigs in their barn.

Table 5. continued. Mean responses for three stockperson attitude and belief questionnaires.
<table>
<thead>
<tr>
<th>Questionnaire Statementa</th>
<th>Questionnaire Statementb</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs are friendly, quiet, and easy to work with</td>
<td>Loading pigs for market requires slow and quiet movement with minimal use of electric prods</td>
<td>0.61</td>
</tr>
<tr>
<td>Pigs are fun-loving, not simple-minded, and make good pets</td>
<td>Loading pigs for market is a pleasant experience</td>
<td>0.40</td>
</tr>
<tr>
<td>Pigs are not gluttonous, dirty, smelly, greedy, ugly or stubborn</td>
<td>Pigs need enrichment in their pens</td>
<td>-0.45</td>
</tr>
<tr>
<td>Pigs are friendly, quiet, and easy to work with</td>
<td>Pigs are perceived in a positive manner by humans</td>
<td>0.47</td>
</tr>
<tr>
<td>Pigs are intelligent, require respect, feel pain like humans, and are excitable when moved forcefully</td>
<td></td>
<td>0.46</td>
</tr>
<tr>
<td>Pigs are fun-loving, not simple-minded, and make good pets</td>
<td></td>
<td>0.37</td>
</tr>
<tr>
<td>Pigs need enrichment in their pens</td>
<td></td>
<td>0.59</td>
</tr>
</tbody>
</table>

II Correlations significant at P ≤ 0.10. Responses on a 5-point likert scale: Subscale: 1=Strongly Disagree with the statement, 3 = Neutral response to the statement, 5 = Strongly Agree with the statement

Table 6. Correlations between a stockperson attitudes and beliefs about working in the pork industry (from the ProHand Pigs, 2011) and b stockperson attitudes and beliefs about pigs and their characteristics.
All Correlations are significant at $P \leq 0.10$. Responses on a 5-point likert scale: Subscale: 1=Strongly Disagree with the statement, 3 = Neutral response to the statement, 5 = Strongly Agree with the statement

Table 7. Correlations between a) stockperson attitudes and beliefs about pigs and their characteristics and b) stockperson attitudes and beliefs about working with pigs under their management.

<table>
<thead>
<tr>
<th>Questionnaire Statementa</th>
<th>Questionnaire Statementa</th>
<th>Questionnaire Statementa</th>
<th>Questionnaire Statementa</th>
<th>Questionnaire Statementa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing pigs is a greater priority than other farm/off-farm responsibilities</td>
<td>Banging and loud noises are not necessary to rouse pigs for daily observation</td>
<td>Talking to pigs while in the barn is good</td>
<td>Electric prods should not be used when loading hogs for market</td>
<td>Little physical and verbal effort is needed to move pigs</td>
</tr>
<tr>
<td>Loading pigs for market is a pleasant experience</td>
<td>Walking through pens daily is good</td>
<td>When walking pens, use of a tool, a kick, or hit to get pigs up is not needed</td>
<td>Little physical and verbal effort is needed to move pigs</td>
<td>Loading pigs for market requires slow and quiet movement with minimal use of electric prods</td>
</tr>
<tr>
<td>Electric prods should not be used when loading hogs for market</td>
<td>Loading pigs for market is a pleasant experience</td>
<td>Walking through pens daily is good</td>
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</tr>
<tr>
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<td>Little physical and verbal effort is needed to move pigs</td>
</tr>
</tbody>
</table>
REFERENCES


Morrison, R. S., L. J. Johnston, A. D. Hilbrands. 2007. The behavior, welfare, growth performance and meat quality of pigs housed in a deep-litter, large group housing system compared to a conventional confinement system. Applied Animal Behavior Science. 103: 12-24


CHAPTER 3: IMPROVING STOCKPERSON ATTITUDES AND BEHAVIOR THROUGH A STOCKPERSON INTERVENTION PROGRAM AND MEASURING THE SUBSEQUENT CHANGES IN PIG BEHAVIOR, CORTISOL CONCENTRATION, AND PRODUCTION MEASURES

ABSTRACT

Contract finishing farms (n = 32) representing two integrated swine entities within Ohio were observed for stockpersons’ tactile and auditory interactions with pigs, as well as the daily work habits. Stockperson questionnaires were completed by all stockpersons to determine the stockperson attitudes toward pigs and about working with pigs. The facilities used in the research housed a minimum of 1000 pigs. A standard observer visited each facility for two consecutive days, at a time designated by the stockpersons, and recorded human behaviors during the daily work. After an initial visit to the facility a pig handling training program was completed by half of the stockpersons. When the next set of pigs in the facility reached the appropriate age, the observers returned to record the stockperson interactions with the pigs to determine if the stockpersons had changed the manner in which they interacted with the pigs. In addition, the stockperson questionnaires were again completed by the stockpersons to determine if there was a change in their attitudes toward the pigs and about working with pigs.

The stockpersons that completed the training program increased their positive attitude toward pigs and also increased their neutral interactions with the pigs while decreasing their mildly negative interactions with pigs. These results demonstrated that
utilizing a stockperson training program with stockpersons in a contract production facility will help improve their attitudes and behavior toward pigs.
INTRODUCTION

The United States (U.S.) has a large swine industry that has seen substantial change over the last 50 years, with a decrease in the total number of operations raising swine and an increase in the number of swine at each operation. In 1961, the U.S. marketed over 74 million hogs for a total of 13 million pounds of pork compared to 113 million hogs in 2009 for a total of 23 million pounds of pork produced (USDA, 2009).

In 1961, there were over 1 million operations that raised swine and by 2010 there were approximately 65,000 operations that raised swine (USDA, 2010). When the numbers of operations are divided into smaller groupings, vast differences among the groups can be seen. The total number of operations marketing between 1 to 99 hogs per year was just over 50,000, whereas the total number of operations marketing over 50,000 hogs per year is approximately 132. However, the operations that market over 50,000 hogs per year control over 56% of the total U.S. swine inventory (Grimes and Lawrence, 2007).

These changes have been made because of advances in housing systems and production science. In the middle of the 20th century pigs were raised in extensive systems that often used outdoor sow huts for shelter. In these extensive, low input systems, many farms would raise enough animals to feed their family and then sell the extra animals at a market. With the progression of indoor housing, more pigs could be raised on a single farm, which brought about greater marketing challenges. Thus, the use of production contracts also increased along with the progression of indoor farming.
The use of production contracts has become common in almost all agricultural industries. In the U.S. swine industry the total number of hogs produced under contract increased from 30% in 1997 to 46% in 2006 (Lawrence and Grimes, 2007). Production contracts have made it possible for operations to grow in size and scale because the company that owns the animals is able to increase total pig numbers without an increase in capital, which means there was a need for more stockpersons to raise the pigs. Because of the increase in the total number of pigs owned by an operation, the need for more stockpersons to raise the pigs was created. A production contract is unique as they specify in detail the production inputs supplied by the contractor (processor, feed mill, other farm operation or business), the quality and quantity of a particular commodity, and the type of compensation to the grower (contractee) for services rendered (USDA, 2011). Because of these changes, many stockpersons decided to forego caring for sows and raising weanling pigs at their own operation and decided to become a contract stockperson instead. The contract stockpersons provide the fixed cost items at their operation and the contract marketing company provides the pigs, the feed, medicine, market access, and management.

The increase in the total number of hogs produced under contract also means that stockpersons have been recruited to raise the pigs from either weaning age or as a feeder pig until market. Contract companies that raise between 50,000 and 500,000 hogs search for stockpersons that do not necessarily have experience raising swine, but are willing to train the stockpersons (Lawrence and Grimes, 2007).

Companies that are willing to train stockpersons can use various training programs that are industry-sponsored, such as Pork Quality Assurance Plus® or
Transportation Quality Assurance®. However, these programs mostly teach the stockpersons about how to: manage a swine facilities, record-keep, properly manage pig health, etc. What the programs have, for the most part, failed to recognize is the influence of the stockperson on the pig’s welfare. In 1994, ProHand Pigs® was validated as a stockperson training program that aimed to improve the stockperson-pig interactions (Hemsworth et al., 2004; ProHand, 2011). ProHand Pigs® was created in Australia and heavily used in the Australia swine industry.

The objectives of the current research are to test the influence of ProHand Pigs® training on stockperson attitudes, beliefs and subsequent behaviors toward pigs reared in contract finishing scenarios where significant variation in background experience working with pigs exists and ownership of pigs resides with an outside entity. We hypothesize that ProHand Pigs® training, a program shown to improve worker behaviors toward pigs through attitudinal change, will reduce the frequency of negative behaviors toward pigs when evaluated in a commercial, contract-finishing swine setting, leading to an overall improvement in pig welfare and potentially an improvement in stockperson job satisfaction.
MATERIALS AND METHODS

Subjects

A total of 32 swine facilities were visited, representing two established pork contractor systems (Contractor A and B) within Ohio. Each contractor provided access to 16 wean-to-finish or feed-to-finish contract grower facilities, with ‘barns’ or ‘rooms’ that had a capacity ranging from 400 to 1200 pigs. Facilities generally contained market pigs, but a sub-sample of 6 facilities from contractor A also marketed replacement females at various time points along the pig growth cycle.

Each facility was visited on two consecutive days with pigs at a target age range of 10 to 14 weeks of age. For biosecurity, blocking, and pig flow reasons, visits were rotated between contractors monthly. Within a contractor, a maximum of two sites per week were visited and eight total facilities visited in a four-week period, followed by a one week break and testing of eight facilities within the second contractor.

Each contractor’s management group was provided details of the research and collaboration agreements were established to allow access to stockpersons and their facilities and for use of relevant production data. All stockpersons were told the objective of the research was to investigate human and pig interactions. Details of the proposed treatment were not discussed because that would have interfered with the validity of the observations and the effectiveness of the control treatment. At the end of the research, all stockpersons were provided full details of the research and the results, and were given an
opportunity to discuss confidentially with the researchers regarding their individual results as described in protocols established by Hemsworth et al. (1994).

Within a contractor, meal-form diets and sequence of the diet changes were the same for all tested facilities. Pigs were provided ad libitum access to feed and water. Within a contractor, pig genetics were similar in breed composition or nearly in similar proportions if multiple lines were present within facilities. Pre-weaning and nursery facility handling were similar within a contractor. In wean-to-finish facilities, pigs were generally double-stocked up to 7 or 8 weeks of age and then split. Pigs from nursery facilities entered the finisher at 7 to 8 weeks of age. During the finishing stage, pigs were provided an industry standard 7.4 to 8.0 ft\(^2\) per pig. All facilities had fully slotted floors and were mechanically ventilated. Each contractor provided Standard Operating Procedures (SOPs) to each stockperson and mandated their own training program for the stockpersons.

**Treatment**

ProHand Pigs\(^\circledast\) training (ProHand) was completed by stockperson assigned to ProHand treatment through a computer-based tutorial aided by a trained facilitator who directed the program and conducted small group discussions. Stockpersons from two to four facilities within a given contractor were gathered to a central location to effectively deliver and conduct the program aims. Within the 4 h computer-based tutorial program, stockpersons were seated at an individual computer and presented with materials supporting findings of research relating to human attitudes and beliefs regarding pigs and provided feedback related to subsequent human behaviors and their influence on pig behavior, pig handling, pig welfare, etc.
ProHand emphasized the importance of minimizing negative behaviors and maximizing positive behaviors as a means to reduce fear responses in pigs and subsequently offer opportunities for improvement in pig handling and performance as well as improve worker attitudes in relation to job satisfaction and roles of the human in relation to pig welfare. Stockpersons in the ProHand group were provided a series of posters that reinforced the ProHand concepts and were encourage to hang and rotate these in their facilities as constant reminders of lessons conveyed. The control group did not attend the ProHand training program, but were provided ProHand training if they desired when all data collection across all facilities and stockpersons was complete.

**Behavior of the Stockperson**

Stockperson behavior observations were made during the stockperson’s normal, daily time for observation of the pigs on two consecutive days. Observations were collected only within the facility and included all actions, auditory sounds, and related activities performed, including, but not limited to, daily facility maintenance, entry into pens, and health checks.

Two experimenters followed the stockperson’s daily walk-through at a distance of 5 to 15 m from the stockperson. One experimenter recorded all human auditory observations while the other experimenter used a video camera to record the stockperson’s tactile interactions and pen activities. Video footage was analyzed to determine the type and frequency of tactile interactions and pen activities. If there was more than one primary stockperson the observers followed the first stockperson on d 1 and the second stockperson on d 2.

**Analysis of Stockperson Observations**
Auditory behaviors were grouped into 1) mouth sounds (TW) such as talking, whistling or other mouth sounds (e.g. clicking or kissing sounds), and 2) hand sounds (HER) such as clapping or slapping one’s hand on a leg (H), hitting equipment with a body part or tool (E), and using a tool that created a rattling sound (R). The variable ALLAUDITORY was calculated and is the sum of TW and HER.

Tactile interactions recorded were classified using the method from Hemsworth et al., (1994). Positive (P) behaviors included patting or stroking, neutral (NEU) behaviors included tapping and standing in the pen, and negative (ALLNEG) behaviors included slaps, hitting and kicking. The ALLNEG category was sub-divided into tactile actions that were moderately negative (MNEG) and included slaps and forceful pushes and very negative (VNEG) that included hits and kicks. The variable ALLTACTILE was calculated and is the sum of P, NEU, MNEG, and VNEG. The frequencies of all behaviors were measured in 5 s bout intervals. For instance, a behavior lasting 4s would be counted as occurring once, where a behavior that lasted 12 s would be counted as occurring three times (Edwards, 2007).

**Units of Measurement**

The frequency of auditory and tactile interactions was standardized to account for the number of pens in a given facility. Standardization included totaling the number of behaviors performed by the stockperson for the day and dividing the total by the number of pens in the stockperson’s facility, allowing reporting of results as the number of observations per pen (Edwards, 2007).

**Location of Pig Observation**
During the daily observation of pigs in their facilities, stockpersons either entered the pens to move throughout the pigs or stayed in the aisle and observed the pigs. This was recorded on both observation days. Categories of stockperson entry were created: if the stockperson entered pens on both days (PEN), if the stockperson entered pens one day and observed from the aisle on the other day (BOTH), and if the stockperson observed from the aisle on both days (AISLE).

**Behavioral Response of Pigs to Humans**

A stroll test similar to Cransberg (2000) was used to assess the pigs’ approach or avoidance from a non-familiar human. On day 1, half of the pens were given the stroll test. On visit day 2, the remaining pens (those not tested on day 1) were given the stroll test. Before the commencement of the stroll test, the experimenter walked the length of the aisle way of the facility to alert the pigs of their presence. A video camera was mounted on a tripod and held in a standard, stationary position to capture a view of the area in front of the experimenter (1 m × 0.6 m). The experimenter entered at the aisle-way corner of the pen (Figure 11), and moved at the pace of one step per second around the pen following a designated path: 1) from the front to the back of the pen, 2) turned and walked across the back of the pen, 3) turned and walked from the back to the front, 4) turned and walked diagonally to the back of the pen, 5) turned and walked across the back of the pen, and 6) diagonally crossed to the front corner of the pen. The video was analyzed and the number of pigs in the field of view of the camera was counted at 5 s intervals in each pen, and the average number reported as STROLL.
Saliva Collection

To gather saliva from pigs to determine cortisol concentrations (CORT), a Salivette® (Sarstedt, Inc., Newton, N. C.) was attached to the end of a 1.5 m length of polyvinyl chloride (PVC) pipe using 16-gauge wire to extend the Salivette® to the randomly targeted focal pig. The focal pig was allowed to chew on the Salivette® until it was thoroughly moistened (2-min max) and that time was recorded (TIME). If the Salivette® was not sufficiently moistened at 2 min, a new pig (same Salivette®) was sampled in a similar area of the pen. In pens with 35 or fewer pigs, two pigs were sampled (one in the front and back of the pen, respectively). In pens with greater than 35 pigs, three pigs were sampled (one in the front, middle, and back of the pen,
respectively). Saliva samples were collected from one half of the pens (the opposite of the pens that were given the stroll test). The second half of the pens had saliva samples collected on day 2, again opposite of the pens that were given the stroll test.

Salivettes® were centrifuged for 15 min at 3000 rpm and within pen samples equally aliquoted to form a single test sample for each pen. Pen samples were stored at -10 F in a freezer until analysis. Samples were assayed for salivary cortisol using a highly sensitive enzyme immunoassay (Salimetrics, State College, PA). The test used 25 µL of saliva per determination, has a lower limit of sensitivity of 0.003 µg/dL, standard curve range from 0.012 µg/dL to 3.0 µg/dL, an average intra-assay coefficient of variation of 3.5%, and an average inter-assay coefficient of variation of 5.1%. Method accuracy determined by spike and recovery averaged 100.8% and linearity determined by serial dilution averaged 91.7%.

**Stockperson Attitude Measurements**

Four questionnaires were provided to the stockpersons after the initial and secondary visit to the facility. Three questionnaires were created specifically for this research and one was created previously for the ProHand program (Hemsworth et al. 1994a). The questionnaires were either mailed or hand-delivered to the stockpersons. Responses to the questionnaire were prefaced by stating in oral or written form that, “As a stockperson with experience working with pigs, your input on the questionnaire is valuable. The information you provide, along with the observations collected in your facility, are valuable to the experiment and interpretation of future findings”.

The questionnaires were designed to assess three areas; 1) working with pigs, 2) attitudes about pigs, and 3) demographic information to further characterize the stockpersons. The questionnaire titles and subscales are listed below.

ProHand Questionnaire:
For all statements a five-point likert scale from strongly disagree to strongly agree was used. All responses were changed in order to make a higher number indicate a more favorable answer.
1. Positive attitude towards pigs
2. Pigs are easy to work with
3. Characteristics of pigs
4. Pigs make good pets

Stockperson Perceived Behavioral Control and Attitude Towards the Behavior Questionnaire:
For all statements a five-point likert scale from strongly disagree to strongly agree was used. All responses were changed in order to make a higher number indicate a more favorable answer.
1. Time spent with pigs at a young age
2. Making a priority to manage pigs
3. Banging on equipment to rouse pigs during daily walkthrough
4. Beliefs about patting of pigs
5. Beliefs about talking to pigs
6. Attitude about using stockboards during medicating and daily walkthroughs
7. Working quietly during market hog loadout
8. Tool use during market hog loadout
9. Use of electric prods during market hog loadout
10. Use of tools, kicks, hits to get pigs up
11. Walking in the pens with pigs is good

Stockperson Attitudes About Pigs Questionnaire:
For all statements a five-point likert scale from strongly disagree to strongly agree was used. All responses were changed in order to make a higher number indicate a more favorable response.
1. Physical and verbal effort required to move pigs
2. Beliefs about ease of loading hogs for market
3. Loading pigs for market is a pleasant experience
4. Pigs need enrichment
5. Positive attitude about pigs
6. Human behavior affects pigs
7. Hogs are harder to handle and load when fed Paylean®

Demographics Questionnaire:
For the demographics questionnaire, the stockpersons were asked to indicate the correct response on the form and write-in any answers that are open-ended

1. Sex: M  F
2. Age
3. Highest Education Level Completed (check highest level of education)
   - Less than high school
   - High school diploma
   - Trade/vocational program
   - Some college
   - Bachelor’s/Associate's degree
   - Graduate or Professional degree
   If so, what degree:
4. Years experience working with pigs
5. Years working as a contract grower
6. Job besides contract growing (example: grain farmer, school teacher)
   - If farming besides contract growing, list type and size of production (example:
     1500 acres of grain farming, 100 head cow/calf operation)
7. Reason for contract growing pigs
8. Number of people that work on your contract grower farm: (circle correct number of
   workers) 1 2 3 4 5 Greater than 5, if so, how many
9. Training that you have had for pig production: (check all that apply)
   - PQA® Plus
   - Transportation Quality Assurance® (also called Trucker Quality Assurance)
   - Courses in High School (example: Vocational Agriculture class)
   - Courses at a university
   - Other: Please specify

Stockperson Log

Stockpersons were asked to complete a time use log at each facility for a period of one week after the visit. A daily log was used to record the time spent in the facility for each person entering, time involved in adjusting water and feed equipment, documentation of if and how long they spent in pens and aisles, time spent managing health, mortality, and other ‘abnormal’ occurrences.

Production Facility Data

Finishing facility capacity and style (single wide, double wide, quad, or auto-sort) and pig age at the time of the visit (AGE) were defined and used as necessary in statistical analyses. Production closeout data were provided for a subsample of groups
within one contractor to assess potential impacts on production measurements. Contractors reported summary information including the number of pigs placed in the facility (PLACED), mortality rate (DIED), percentage of pigs culled (CULLED), percentage of pigs sold as breeding stock (BREED), percentage of pigs sold to market (MARKET), percentage of pigs transferred out of the facility (TRANSFER), number of days that pigs were in the facility (TOTAL DAYS), average daily gain (ADG), and feed conversion (F:G). As a measure of potential pig stress at load out and in transportation, the percentage of pigs dead on arrival at the abattoir (DOA) were reported. The percent of pigs classified as leaving under positive circumstances (GOOD) was the sum of MARKET, TRANSFER and BREED percentages. Total percentage of pigs removed (BAD) was the sum of DEAD and CULLED.

**Statistical Analysis**

For all analyses, cortisol concentration, average time to gather a saliva sample, and the stockperson time per pen were transformed using a Log10 transformation. For reporting, means were back-transformed and confidence intervals were calculated and back-transformed.

Dependent measures of stockperson tactile and auditory actions, pen activities, pig measurements, and production variables were analyzed using the mixed procedure of SAS (v9.2; Cary, N.C.). Models for tactile, auditory actions, pen activities, pig measurements and production variables included fixed effects of Contractor (A and B), Training (Prohand Training of No Training), Round (Pre-training or Post-Training), and the interaction of Training × Round to specifically look at change due to Training. Random model effects were Facility nested within Contractor and Day of Observation (1
or 2). The MANOVA procedure within the GLM procedure of SAS was used to assess the residual/partial correlation among stockperson observation and pig response variables after accounting for fixed effects described above. The partial correlations allow a more direct observation of the relationships between stockperson actions and pig behaviors after adjusting for known sources of extraneous variation.

Relationships within and across questionnaires (Stockperson attitudes and beliefs about working in the pork industry (from ProHand Pigs, 2011), Stockperson attitudes and beliefs about working with pigs in their barn, and Stockperson attitudes and beliefs about pigs and pig their characteristics) were analyzed using the correlation procedure in SAS. Questionnaire descriptive statistics were analyzed using the means procedure in SAS. The interaction of Treatment (training/no training) with Round or timing of data collection (pre-training vs. post-training) of data collection was the primary consideration for statistical separation and identification of the change in response variables due to the ProHand training intervention.
RESULTS AND DISCUSSION

Descriptive Statistics

Summary statistics including number of observations, simple means, standard deviations, confidence intervals, and minimum and maximum values are shown in Table 8. Data were censored and four facilities were removed from the experiment, three because of a change in the managing stockperson and one because of severe pig illness within the facility at the time of post-training observation.

Human Pig Interactions Tactile and Auditory with pen or aisle info

Least squares means of the ProHand x Round interactions and for the main effects of Contractor and ProHand (for each round) for all human behaviors, and pig behavior and cortisol concentrations are presented in Tables 9, 10, and 11, respectively. Cortisol concentration was the only variable that had a significant (P < 0.05) main effect of contractor prior to training (A = 1.43 ng/ml; B = 1.03 ng/ml, Confidence Interval (1.09-1.36 ng/ml)). For the ProHand main effect, there was also only one significant difference (P < 0.05), the ProHand stockpersons had a greater frequency of adjusting equipment while in the pen than Control stockpersons (ProHand = 0.75 adjustments/pen; C = 0.29 adjustments/pen, ± 0.20 adjustments/pen).

There was no ProHand x Round interaction (P > 0.18) for the P. This is the opposite of what Hemsworth and colleagues (1994) found. In their research the training group increased the number of positive interactions significantly when compared to the control group.
The frequency of NEU interactions changed following post-training observations, whereby stockpersons receiving ProHand training increased the frequency of NEU interactions by 0.81 units and the Control improved by only 0.30 interactions (P < 0.006), indicating that ProHand training had a greater change (improvement) in the number of neutral interactions with pigs when compared with the Control stockpersons. Both the ProHand and Control stockpersons decreased the frequency of MNEG tactile interactions with pigs; however, the stockpersons receiving ProHand training decreased the frequency by a greater amount (ProHand = 0.70; C = 0.47, ± 0.23 actions/pen) than Control stockpersons. This is somewhat different than what Hemsworth et al. (1994) reported, because in their research the control group increased the number of negative behaviors while the training group decreased the number of negative behaviors towards pigs. Along with a decrease in negative behaviors in the Hemsworth research, there was a significant treatment effect whereby the training group was observed to have an increase in the number of positive interactions. In the current study, there was no change in the number of positive interactions among treatment groups, rather there was a shift in the proportions of neutral and moderately negative interactions with both measures improving for stockpersons receiving training when compared with their contemporary control groups. In research conducted with dairy cows, Hemsworth et al. (2002) also reported a significant training x round interaction where the treatment group used fewer moderately negative interactions more than the control group. Unlike the current research, Hemsworth and colleagues (2002) also found that the treatment stockpersons used more positive and fewer very negative interactions, while the total number of interactions per cows did not change.
It is important to understand that there was a beneficial training effect in the current research, notably that ProHand training lead to a reduction in the number of moderately negative interactions and an increase in the number of neutral interactions with pigs. There was no ProHand x Round interaction for ALLTACTILE, indicating that the stockpersons did not change the total number of tactile interactions with pigs within a pen; rather the ProHand trained stockpersons shifted the frequency of their tactile interactions toward neutral to a statistically greater change than was present in the Control stockpersons.

Changes in tactile behaviors become more apparent when the tactile interaction variables are converted to a percentage of the total number of tactile interactions observed. ProHand stockpersons had a 26% increase in NEU, while decreasing MNEG by 15.26%, while the Control stockpersons increased NEU by 14% and decreased MNEG by 9.1%. These results are similar to those in Coleman (2000), where there was a decrease in negative interaction for both the training and control group, but the training group’s reduction was greater. In addition, the magnitude of the change for the training group in negative behaviors (15.71%) in the Coleman study was similar to the current research’s training group (15.26%).

There was a significant ProHand x Round effect (P < 0.004), where ProHand stockpersons had a decline in ALLAUDITORY from 1.40 to 1.11 sounds/pen while the Control stockpersons increased from 1.39 to 1.56 sounds/pen. In addition, there were interaction effects for TW and CER where ProHand stockpersons increased TW by 0.11 actions/pen decreased CER by 0.40 actions/pen and while Control stockpersons decreased the total number of TW by 0.23 actions/pen and increased CER by 0.4
actions/pen. The importance of the stockpersons in the ProHand group decreased in claps, hitting equipment, and using rattle paddles, while the Control stockpersons increased. This difference was large and that it created a significant interaction for ALLAUDITORY. In the ProHand training program, stockpersons were taught to work quietly around pigs, especially not using loud voices, whistles, or using tools to make loud noises (ProHand, 2011). While the volume of the talking and other mouth sounds was not measured, the sounds were usually softer in nature as opposed to banging on equipment to rouse pigs.

There was a significant ProHand x Round interaction for WAVE (P < 0.0001), where ProHand and Control decreased (1.09 to 0.69 and 1.81 to 0.80 waves/pen respectively). Although Control stockpersons had a greater decrease in waves/pen, the ProHand stockpersons ended at a lower number of waves/pen. There were no significant treatment interactions for BOARD, ADJUST, OR PENTIME (P > 0.05).

**Pig Data**

There were ProHand x Round interactions for CORT, TIME, and STROLL (P < 0.01). The ProHand treatment had a greater increase in CORT than Control, however the difference between the round 2 (post-training) CORT for ProHand and Control was 0.16 ng/ml. This difference may not be biologically significant despite the statistical difference. Hemsworth and Barnett (1991) showed no cortisol concentration differences between pleasantly and unpleasantly handled pigs and the concentrations were similar to those found in this research. In addition, the cortisol concentrations are similar to those that Morrison et al. (2007) found in their research of pigs at daytime baseline levels at a similar age.
There was a significant ProHand x Round interaction (P < 0.0006) for TIME where the Control stockpersons had a greater decrease from 49.6 s to 36.4 s than the ProHand stockpersons 49.2 s to 40.2 s. There was also a ProHand x Round interaction for STROLL where ProHand stockpersons decreased from 2.68 to 2.38 pigs/frame while the Control stockpersons increased from 2.40 to 2.53 pigs/frame. Passille and Rushen (2005) have shown concern for trying to gauge improvement in stockperson and animal interactions using the animals’ responses to humans. They stated that it is difficult to track even, “quite substantial improvements in the stockmen’s handling of the animals” when approach/avoidance tests are used to determine fear or avoidance levels of humans. Perhaps the stroll test in the present research is not measuring exactly what it was proposed to measure and instead, possibly measured excitement levels or attention to a novel human—or the human as a novel object if they were not accustomed to humans being present in the barn, more specifically, the pen.

**Correlations**

Correlations for CORT, STROLL, TIME, and human behaviors are reported in Table 11. Pearson product moment correlations as well as partial correlations were analyzed and when merited, differences between the two correlations will be explained. The correlation between CORT and STROLL was positive, although weak. Perhaps the positive association is due to the stockperson treating the pigs in a manner that they are excited when the stockperson enters the facility, which would elevate cortisol concentrations, and the pigs are subsequently willing to approach the stockperson.

When analyzed with MANOVA, the direction of the CORT and STROLL relationship changed to negative, but weak. This relationship is indicative of the
correlation when the facility, contractor, and treatment were controlled for, so perhaps a “truer” view of the response of the pig. TIME and CORT were positively correlated, meaning that pigs that had higher cortisol concentrations took longer to sample. The experimenters were careful not to sample a single animal for more than 2 m, in order to avoid measuring the pig’s reaction to the sampling following the method of Morrison et al., 2007. There is the possibility that an increase in TIME could excite other pigs in the pen, therefore increasing CORT. However, the procedure was the same throughout the research so it is plausible that in facilities where the pigs were more fearful, they would have a greater reaction to the stress of the sampling the process overall, which would increase CORT as well as TIME. The variable P had a weak, positive correlation with CORT ($r = 0.06$). The other tactile variables NEU, MNEG, VNEG, ALLNEG were all weakly, negatively associated with CORT, which would indicate that an increased incidence of neutral and negative tactile behaviors would decrease cortisol concentrations. This would not seem to be an advantageous relationship. In addition, the positive correlation of CORT and P would indicate that an increase in the frequency of positive human tactile interactions with pigs also increases cortisol concentrations. These correlations seem to be counterintuitive since increased cortisol concentrations are most often considered unfavorable. However, these relationships were very weak and should be interpreted with caution.

An increase in STROLL was weakly, positively correlated with both human auditory interactions, TW and CHR. Only VNEG had a negative association with stroll. At $r = -0.085$, the relationship is weak but suggested that the most negative human behaviors towards pigs could increase the pigs’ avoidance of humans. All tactile
interactions (P, NEU, MNEG, VNEG, and ALLNEG) were correlated with STROLL. There was also a weak, positive correlation between STROLL and WAVE. These results also perhaps suggest that if the pigs were close to the stockperson (increased STROLL) more tactile interactions and waving from the stockperson would be natural in order to move the pigs away from them to more easily view the pigs or to retain stockperson safety. Finally, the positive Pearson correlation for PENTIME and stroll was weak ($r = 0.12$). When facility was accounted for in the model, the correlation increased to $r = 0.65$. This suggests that there were facilities that were not representative of the true relationship between PENTIME and STROLL. Stockpersons that examined from the aisle could be a reason for this discrepancy because PENTIME was calculated as an average of total time in the facility and not specifically describing time in the pen or aisle. The stronger correlation means that the more time that the stockpersons spent in the barn, the greater number of pigs present, which may be a reason for the positive correlation.

The variable TW had a lowly moderate correlation for TIME ($r = 0.20$). This would mean that the more frequently a stockperson talks, whistles, or makes other vocalizations, the longer it would take to gather a saliva sample from a pig. The experimenters in the current research did not record the volume of the vocalizations. ProHand Pigs stresses the importance of talking to pigs in a soft, calming tone (ProHand, 2011). Therefore, it could be counterintuitive that those that vocalize more have pigs that have a higher TIME.

Both TW and CHR were at least lowly correlated with all tactile interactions. They were both negatively associated with P, meaning with an increase in TW and CHR, there would be a decrease in P. For TW, the Pearson correlations with PENTIME,
MNEG, VNEG, and ALLNEG were noticeably higher than the partial correlations. The Pearson correlations had higher values, which could lead to the thought that there were certain stockpersons that more heavily influenced the relationships between vocalizations, negative interactions, and time that the stockperson spent observing in the pen.

PENTIME was associated with all variables except CORT and TIME. There were positive associations for all tactile interactions and PENTIME. These results are expected as the longer a stockperson spends in the facility and in pens, the more likely they are to use tactile interactions with pigs. The only large discrepancy between the Pearson and Partial correlations for PENTIME was for VA ($r = 0.48; r = 0.17$, respectively). This difference points to the possibility that there were facilities that used VNEG interactions with greater frequency during their time within a pen (PENTIME) than the majority of the facilities.

WAVE is similar to PENTIME in that for VNEG, ALLNEG, and PENTIME there was a larger Pearson correlation than Partial. When examining the data, it appears that there was only a small percentage of stockpersons that normally and frequently waved a hand or tool during their walkthrough. The correlation shows that as a stockperson increased WAVE, they would also increase the total number of NEU, MNEG, VNEG, and ALLNEG. Also, if a stockperson waved a hand or tool, there would be an increase in vocalizations.

In conclusion, the longer a stockperson was in the facility and pens, there was an increased likelihood that they increased their total number of tactile and vocal interactions. The increase in PENTIME could also lead to an increase in STROLL,
resulting in a decreased avoidance of humans. Nearly all of the tactile and auditory interactions were correlated. This is important because it means that if a stockperson used one behavior, it is likely that they used all tactile and auditory interactions.

**Production data**

No significant ProHand x Round interactions were found for the variables MARKET, DIED, CULL, GOOD, BAD, and F:G (P > 0.14). There were ProHand x Round interaction trends for DOA and ADG (P < 0.06) where Control stockpersons had a greater decrease in DOA and a greater increase in ADG than ProHand stockpersons.

**Questionnaire Subscale Results**

For the stockperson attitudes and beliefs about working in the pork industry questionnaire (PHQ), there was a ProHand x Round interaction for the subscale, ‘pigs are not gluttonous, dirty, smelly, greedy, ugly or stubborn’ statements (P < 0.02). The ProHand training resulted in an increased positive attitude about pigs, while the control stockpersons decreased their positive attitude towards pigs. This is similar to the results of Hemsworth et al. (1994) where a significant increase in what they considered a positive attitude subscale was achieved. There was a trend (P < 0.06) for the ProHand stockpersons to increase their belief that pigs are easy to work with, while the Control stockpersons slightly declined in their belief. There were no training effects on the other subscales, ‘pig characteristics’ and ‘pigs as pets’ (P ≥ 0.59).

For the ‘stockperson attitudes toward working with pigs in their barn’ (Q1), ProHand stockpersons increased their agreement to the statements “pigs find it unpleasant when a tool, hit, or kick is used to get them up and moving when doing daily walkthroughs and checking on pigs” and “it is best not to use loud voices and whistle
around hogs during load out for market” (P < 0.02), while the Control stockpersons increased their disagreement to the statements. There were no ProHand x Round interactions for Q1 subscales.

For the ‘stockperson attitudes and beliefs toward pigs and pig handling’ (Q2), there was a trend for the ProHand stockpersons to increase their agreement to the statement, “when loading for market, it is necessary to move slowly and quietly around the hogs” (P < 0.08), while the Control stockpersons increased in their disagreement about the statement. There were no ProHand x Round interactions for Q2 subscales.

**Questionnaire Correlations with Cortisol Concentrations, Stroll Test Results, and Mean Time Needed to Gather a Saliva Sample**

Correlations that were significant at P < 0.10 are shown in tables 13,14,15. For Q1, ‘using a sorting board is necessary when moving or medicating pigs’ was negatively associated with STROLL (r = -0.25), CORT (r = -0.24), and TIME (r = -0.29). The associations with CORT and TIME are favorable as it indicates that as the stockperson increased their agreement to using a board when working with pigs, the cortisol concentration of the pigs was lower and the time to collect saliva samples decreased. This would lead to the thought that if a stockperson has the belief that a board should be used when moving and working around pigs, it could lead to a pig that takes a shorter amount of time to sample and could have lower cortisol concentrations. ‘It is important to spend more time with pigs when they are young’ was also negatively correlated with TIME (r = -0.28), meaning that if the stockperson believed that more time should be spent with pigs when they are young, the less time would be needed to gather saliva samples. ‘It is important to spend more time with pigs when they are young’ and ‘talking to pigs while
in the barn is good’ were negatively correlated \((r = -0.24)\). TIME is positively correlated with ‘patting pigs while in the barn is good’ and ‘talking to pigs while in the barn is good’. Stockpersons that believe more time should be spent with pigs, the more likely they are to have the belief that talking to, and patting pigs is good. Furthermore, ‘talking to pigs while in the barn is good’ and ‘patting pigs while in the barn is good’ are moderately strongly correlated \((r = 0.62)\). This is a favorable relationship because those that talked with pigs were likely to pat pigs, which is a positive tactile interaction.

The subscale ‘managing pigs is a greater priority than other off-farm responsibilities’ was positively associated with the subscales ‘the use of tools, kicks, and hits to get pigs up is bad’ \((r = 0.27)\), ‘patting pigs while in the barn is good’ \((r = 0.26)\), and ‘talking to pigs while in the barn is good’ \((r = 0.24)\). These favorable relationships mean that a stockperson that believes that tools, hit, and kicks do not need to be used to arouse pigs also has the beliefs that more time should be used with pigs, are more likely to pat pigs, and more likely to talk to pigs.

‘Using a loud voice or whistling when loading hogs for market is bad’ was positively correlated with ‘banging and loud noises are not necessary to rouse pigs for daily observation’ \((r = 0.30)\). This association is favorable because the positive correlation reflects that a stockperson that believes one should not bang on gates or equipment also believes that it is better to work and move quietly when loading pigs.

Finally, the ‘electric prods should not be used when loading hogs for market’ variable is positively associated with ‘talking to pigs while in the barn is good’ \((r = 0.28)\) and ‘using a loud voice or whistling when loading hogs for market is bad’ \((r = 0.32)\). The correlation points to associations that if a stockperson believes that an electrical prod is needed
loading pigs, they are also likely to believe that one should make attempts to talk to pigs and also should work quietly around pigs during loadout. ‘Electric prods should not be used when loading hogs for market’ was negatively associated with ‘using tools such as rattle paddles, sorting boards or pvc-pipes when loading hogs for market is good’ (r = -0.34). This is an interesting relationship because if a stockperson believes that using an electrical prod is necessary during loadout, they are less likely to believe that other tools are needed during loadout.

There are three correlations that may need further examination: CORT and ‘banging and loud noises are not necessary to rouse pigs for daily observation’ (r = 0.27), CORT and ‘using tools such as rattle paddles, sorting boards or pvc-pipes when loading hogs for market is good’ (r = 0.27), and ‘it is important to spend more time with pigs when they are young’ and ‘talking to pigs while in the barn is good’ (r = -0.24). The positive relationships make the connection that an increase in the stockperson belief that banging on equipment is a bad idea and that using tools when loading pigs for market will be tied to an increased cortisol concentration.

For Q2, ‘little physical and verbal effort is needed to move pigs’ is positively correlated with ‘pigs need enrichment in their pens’ (r = -0.23), and ‘pigs are perceived in a positive manner by humans’ (r = 0.34). Stockpersons that have the belief that pigs take little effort to move are more likely to believe that pigs should be provided enrichment and also believe that human behaviors in the facility can affect the pigs. ‘Actions toward pigs (speed of movement, entry into pens, actions within pens, and level of attention) influence the pig’s behavior’ is positively associated with ‘loading pigs for market is a pleasant experience’ (r = 0.24). ‘Loading pigs for market requires slow and quiet
movement with minimal use of electric prods’ was positively correlated with ‘pigs are perceived in a positive manner by humans’ (r = 0.30), which is a advantageous relationship because if a stockperson perceives pigs in a positive manner, the less likely they are to believe that it necessary to use prods at loadout.

**Inter-Questionnaire Relationships**

All correlations reported in Tables 16, 17, 18 are significant at P ≤ 0.10. ‘Pigs are intelligent, require respect, feel pain like humans, and are excitable when moved forcefully’ (PHQ) was positively correlated with ‘loading pigs for market is a pleasant experience’ (r = 0.27), ‘loading pigs for market requires slow and quiet movement with minimal use of electric prods’ (r = 0.36), ‘pigs are perceived as non-destructive, liking humans, and non-aggressive toward humans’ (r = 0.21), and ‘feeding of Paylean does not make pigs more excitable or more difficult to load for market’ (r = 0.21) (Q2) and ‘banging and loud noises are not necessary to rouse pigs for daily observation’ (r = 0.28) (Q1). All of the correlations were desirable. In addition, there is a negative correlation between ‘pigs are intelligent, require respect, feel pain like humans, and are excitable when moved forcefully’ (PHQ) and ‘using a sorting board is necessary when moving or medicating pigs’ (r = -0.22) (Q1). ‘Pigs are friendly, quiet, and easy to work with’ (PHQ) was positively correlated with ‘pigs are perceived as non-destructive, liking humans, and non-aggressive toward humans’ (r = 0.47) and ‘banging and loud noises are not necessary to rouse pigs for daily observation’ (r = 0.22) and ‘patting pigs while in the barn is good’ (r = 0.29) (Q1). ‘Pigs are intelligent, require respect, feel pain like humans, and are excitable when moved forcefully’ (PHQ) was positively related to ‘banging and loud
noises are not necessary to rouse pigs for daily observation’ (r = 0.28) and ‘using a loud voice or whistling when loading hogs for market is bad’ (r = -0.22) (Q1).

‘Actions toward pigs (speed of movement, entry into pens, actions within pens, and level of attention) influence the pig’s behavior’ (Q2) and ‘walking through pens daily is good’ (Q1) were positively correlated (r = 0.27). ‘Banging and loud noises are not necessary to rouse pigs for daily observation’ (Q1) was positively correlated with ‘little physical and verbal effort is needed to move pigs’ (r = 0.29), ‘loading pigs for market requires slow and quiet movement with minimal use of electric prods’ (r = 0.25), ‘actions toward pigs (speed of movement, entry into pens, actions within pens, and level of attention) influence the pig’s behavior’ (r = 0.45) (Q2), and negatively correlated with ‘feeding of Paylean® does not make pigs more excitable or more difficult to load for market’ (r= -0.21) (Q2). ‘Pigs are perceived as non-destructive, liking humans, and non-aggressive toward humans’ (Q2) was positively with ‘patting pigs while in the barn is good’ (r = 0.31) and ‘talking to pigs while in the barn is good’ (r = 0.31) (Q1). ‘Using a loud voice or whistling when loading hogs for market is bad’ (Q1) was positively associated with ‘little physical and verbal effort is needed to move pigs’ (r = 0.39), ‘loading pigs for market requires slow and quiet movement with minimal use of electric prods’ (r = 0.33), and ‘pigs need enrichment in their pens’ (r = 0.23) (Q2). ‘Little physical and verbal effort is needed to move pigs’ (Q2) was positively correlated with ‘electric prods should not be used when loading hogs for market’ (r = 0.23) (Q1).

‘Loading pigs for market is a pleasant experience’ (Q2) was correlated with the following Q1 subscales: Positively) ‘banging and loud noises are not necessary to rouse pigs for daily observation’ (r = 0.31) and ‘it is important to spend more time with pigs when they
are young’ (r = 0.28) and negatively with ‘talking to pigs while in the barn is good’ (r = -0.29), ‘patting pigs while in the barn is good’ (r = -0.31), ‘electric prods should not be used when loading hogs for market’ (r = -0.31), ‘managing pigs is a greater priority than other off-farm responsibilities’ (r = -0.27), and ‘using a sorting board is necessary when moving or medicating pigs’ (r = -0.24).
IMPLICATIONS

Many of the current stockperson training programs used in the swine industry focus on the care of pigs for example: managing pig illness, record-keeping, or improving pig transportation for those pigs being brought to or taken from a farm. The importance of stockperson attitudes and behavior have not been the focal point of training. ProHand Pigs® training brings interactions of the stockperson and pigs to the forefront in order to help the stockpersons understand the critical nature of their interactions with the pigs.

The results of the present research are similar to past research (Hemsworth et al., 1994; Hemsworth et al., 2002) where similar changes in stockperson behaviors, attitudes, and beliefs were found, which led to positive changes in production characteristics. The results support the use of a training program to improve stockperson attitude and behavior toward pigs under their care.

When the data from the current research were analyzed, it was shown that the stockpersons improved their attitudes for certain statements and a ‘positive’ attitude subscale, along with improved tactile interactions with the pigs, fewer waves, less frequently banged on equipment, used a rattle, clapped, and used fewer auditory actions overall. Therefore, it can be concluded that the research has improved the stockperson behaviors towards market pigs and has improved some attitudes and beliefs about market pigs. These changes can lead to improvements in stockperson attitudes, beliefs, and in particular, behaviors toward pigs as they associate with stockperson job satisfaction, job performance, pig welfare, and pig production measures. Implementation of ProHand
Pigs® training in the Ohio and U.S. swine industries would be beneficial to the stockpersons as well as the pigs and would provide a training module that uses improving stockperson and pig interactions as the focal point.
### ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Variable&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
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<sup>a</sup>Positive: patting or stroking pigs; Neutral: tapping pigs or standing in the pen; Moderately Negative: slaps and forceful pushes on pigs; Very Negative: hitting and kicking pigs; Total Negative: sum of Moderately and Very Negative; Total Tactile: sum of all tactile actions; Total Auditory: sum of all auditory actions; Cortisol: salivary cortisol concentration, (minimum two pigs sampled per pen); Cortisol time: average time required per pig to collect salivary cortisol; Stroll: average number of pigs present in a video, frame captured at 5 second intervals, per pen; Time of Day: average time of day cortisol samples were collected.

<sup>b</sup>Frequency of actions or activities per pen

Table 8. Descriptive Statistics for Stockperson Tactile and Auditory Actions and Pig Measurements for observations collected on two consecutive groups of pigs.
<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>ProHand x Round Interaction</th>
<th>ProHand</th>
<th>Control</th>
<th>Pooled SEM/CI</th>
<th>Inter-</th>
<th>ace P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tactile Actions</strong></td>
<td></td>
<td>Pre-training</td>
<td>Post-training</td>
<td>Pre-training</td>
<td>Post-training</td>
<td></td>
</tr>
<tr>
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<td>0.30</td>
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<td>2.51&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.81&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.11&lt;sup&gt;ab&lt;/sup&gt;</td>
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<td>Moderately</td>
<td>Negative</td>
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<td>Pre-training</td>
<td>Post-training</td>
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<td>Post-training</td>
<td>Pre-training</td>
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<td>11:26&lt;sup&gt;b&lt;/sup&gt;</td>
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<sup>a</sup> Means in a row without a common superscript differ (P < 0.05)
<sup>b</sup> Frequency of actions or activities per pen
<sup>c</sup> Positive: patting or stroking pigs; Neutral: tapping pigs or standing in the pen; Moderately Negative: slaps and forceful pushes on pigs; Very Negative: hitting and kicking pigs; Total Negative: sum of Moderately and Very Negative; Total Tactile: sum of all tactile actions; Total Auditory: sum of all auditory actions; Cortisol: salivary cortisol concentration, (minimum two pigs sampled per pen); Cortisol time: average time required per pig to collect salivary cortisol; Stroll: average number of pigs present in a video, frame captured at 5 second intervals, per pen; Time of Day: average time of day cortisol samples were collected.

Table 9. Interaction of treatment (ProHand and Control) and round (pre-training and post-training) effects on stockperson tactile and auditory actions during daily pig observation and subsequent measures of pig responses to humans.
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<tr>
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<th>ProHand</th>
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<tr>
<td>Talk and Whistle</td>
<td>0.82</td>
<td>1.14</td>
<td>0.79</td>
</tr>
<tr>
<td>Clap, Hit Equipment, Rattle</td>
<td>0.46</td>
<td>0.36</td>
<td>0.50</td>
</tr>
<tr>
<td>All Auditory</td>
<td>1.28</td>
<td>1.50</td>
<td>1.29</td>
</tr>
<tr>
<td><strong>Pen Activities</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wave arms</td>
<td>1.29</td>
<td>1.53</td>
<td>1.23</td>
</tr>
<tr>
<td>Use of Sort Board</td>
<td>0.03</td>
<td>0.10</td>
<td>0.03</td>
</tr>
<tr>
<td>Adjust Equipment</td>
<td>0.45</td>
<td>0.59</td>
<td>0.75&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Stockperson Time/pen, sec</strong></td>
<td>34.8</td>
<td>33.1</td>
<td>33.0</td>
</tr>
<tr>
<td><strong>Pig Measurements</strong>&lt;sup&gt;c&lt;/sup&gt;</td>
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<tr>
<td>Cortisol, ng/ml</td>
<td>1.43&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.03&lt;sup&gt;d&lt;/sup&gt;</td>
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<tr>
<td>Cortisol time, sec</td>
<td>48.6</td>
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<tr>
<td>Stroll, # pigs</td>
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<td>2.63</td>
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<tr>
<td>Time of Day, hh:mm</td>
<td>11:21</td>
<td>12:40</td>
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</table>

<sup>a</sup>Positive: patting or stroking pigs; Neutral: tapping pigs or standing in the pen; Moderately Negative: slaps and forceful pushes on pigs; Very Negative: hitting and kicking pigs; Total Negative: sum of Moderately and Very Negative; Total Tactile: sum of all tactile actions; Total Auditory: sum of all auditory actions; Cortisol: salivary cortisol concentration, (minimum two pigs sampled per pen); Cortisol time: average time required per pig to collect salivary cortisol; Stroll: average number of pigs present in a video frame captured at 5 second intervals per pen; Time of Day: Average time cortisol samples were collected.

<sup>b</sup>Frequency of actions or activities per pen

<sup>c</sup>dMeans in a row without a common superscript differ (P < 0.05)

Table 10. Main effect of treatment (ProHand (YES) and Control (NO)) and Contractor (A and B) on stockperson tactile and auditory actions during daily pig observation and subsequent measures of pig responses to humans prior to implementation of ProHand training.
<table>
<thead>
<tr>
<th>Dependent Variable&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Contractor A</th>
<th>Contractor B</th>
<th>ProHand Yes</th>
<th>ProHand No</th>
<th>Pooled S.E./C.I.</th>
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</thead>
<tbody>
<tr>
<td><strong>Tactile Actions&lt;sup&gt;b&lt;/sup&gt;</strong></td>
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<tr>
<td>Positive</td>
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<tr>
<td>Neutral</td>
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<td>2.29</td>
<td>2.17</td>
<td>0.51</td>
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<tr>
<td>Moderately Negative</td>
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<td>0.41</td>
<td>0.56</td>
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</tr>
<tr>
<td>Very Negative</td>
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<td>0.68</td>
<td>0.27</td>
<td>0.75</td>
<td>0.33</td>
</tr>
<tr>
<td>Total Negative</td>
<td>1.17</td>
<td>1.1</td>
<td>0.79</td>
<td>1.47</td>
<td>0.39</td>
</tr>
<tr>
<td>Total Tactile</td>
<td>4.37</td>
<td>3.27</td>
<td>3.61</td>
<td>4.02</td>
<td>0.78</td>
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<tr>
<td><strong>Auditory Actions&lt;sup&gt;b&lt;/sup&gt;</strong></td>
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<td>Talk and Whistle</td>
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<td>0.75</td>
<td>0.81</td>
<td>0.36</td>
</tr>
<tr>
<td>Clap, Hit Equipment, Rattle</td>
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<td>0.11</td>
<td>0.37</td>
<td>0.54</td>
<td>0.34</td>
</tr>
<tr>
<td>All Auditory</td>
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<td>0.62</td>
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<td><strong>Pen Activities&lt;sup&gt;b&lt;/sup&gt;</strong></td>
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<tr>
<td>Wave arms</td>
<td>0.83</td>
<td>0.62</td>
<td>0.66</td>
<td>0.79</td>
<td>0.27</td>
</tr>
<tr>
<td>Use of Sort Board</td>
<td>0.05</td>
<td>0.001</td>
<td>0.03</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Adjust Equipment</td>
<td>0.30</td>
<td>0.62</td>
<td>0.70&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.22&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.17</td>
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<tr>
<td><strong>Stockperson</strong></td>
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</tr>
<tr>
<td>Time/pen, sec</td>
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<td>27.3</td>
<td>31.6</td>
<td>31.2</td>
<td>24.0-41.1</td>
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<tr>
<td><strong>Pig Measurements</strong></td>
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</tr>
<tr>
<td>Cortisol, ng/ml</td>
<td>1.39</td>
<td>1.19</td>
<td>1.30</td>
<td>1.27</td>
<td>1.16-1.42</td>
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<tr>
<td>Cortisol time, sec</td>
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<td>36.9</td>
<td>39.9</td>
<td>36.8</td>
<td>35.3-41.5</td>
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<tr>
<td>Stroll, # pigs</td>
<td>2.95&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.95&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2.35</td>
<td>2.56</td>
<td>0.13</td>
</tr>
</tbody>
</table>

<sup>a</sup>Positive: patting or stroking pigs; Neutral: tapping pigs or standing in the pen; Moderately Negative: slaps and forceful pushes on pigs; Very Negative: hitting and kicking pigs; Total Negative: sum of Moderately and Very Negative; Total Tactile: sum of all tactile actions; Total Auditory: sum of all auditory actions; Cortisol: salivary cortisol concentration, (minimum two pigs sampled per pen); Cortisol time: average time required per pig to collect salivary cortisol; Stroll: average number of pigs present in a video, frame captured at 5 second intervals, per pen; Time of Day: average time of day cortisol samples were collected.

<sup>b</sup>Frequency of actions or activities per pen

<sup>cd</sup>Means in a row without a common superscript differ (P < 0.05)

Table 11. Main effect of treatment (ProHand (YES) and Control (NO)) and contractor (A and B) on stockperson tactile and auditory actions during daily pig observation and subsequent measures of pig responses to humans after implementation of ProHand training.
Partial correlations adjusted for treatment (ProHand and control) and Round (pre-training and post-training) model effects.

Coding: 1 = Salivary cortisol concentration, ng/ml; 2 = average number of pigs present in a video frame at 5 second intervals for each pen sampled; 3 = average time required per pig to collect salivary cortisol sample; 4 = Vocalizations, number per pen; 5 = Clapping, hand sounds, rattling sounds, number per pen; 6 = Physically pick up pigs, number per pen; 7 = Positive: patting or stroking pigs, number per pen; 8 = Neutral: tapping pigs or standing in the pen, number per pen; 9 = Moderately Negative: slaps and forceful pushes on pigs, number per pen; 10 = Very Negative: hitting and kicking pigs, number per pen; 11 = Total Negative: sum of Moderately and Very Negative, number per pen; 12 = Average stockperson time spent in the pen, seconds; 13 = Stockperson waving within pen, number per pen; 14 = Stockperson use of sorting board in pen, number per pen; 15 = Stockperson adjustment of feeding or watering equipment in pen, number per pen.

Table 12. Pearson (upper) and partial\(^b\) (in parentheses) correlations among stockperson (auditory, tactile, and pen activity) and pig measures (stroll, cortisol concentration, and time to gather salivary cortisol sample) for assessment of pig and human interaction effects (P < 0.05)

<table>
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<th>4</th>
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<th>13</th>
<th>15</th>
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<tbody>
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<td>-0.06</td>
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<td>2</td>
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<td>0.19</td>
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</tbody>
</table>

\(^a\)Partial correlations adjusted for treatment (ProHand and control) and Round (pre-training and post-training) model effects.

\(^b\)Coding: 1 = Salivary cortisol concentration, ng/ml; 2 = average number of pigs present in a video frame at 5 second intervals for each pen sampled; 3 = average time required per pig to collect salivary cortisol sample; 4 = Vocalizations, number per pen; 5 = Clapping, hand sounds, rattling sounds, number per pen; 6 = Physically pick up pigs, number per pen; 7 = Positive: patting or stroking pigs, number per pen; 8 = Neutral: tapping pigs or standing in the pen, number per pen; 9 = Moderately Negative: slaps and forceful pushes on pigs, number per pen; 10 = Very Negative: hitting and kicking pigs, number per pen; 11 = Total Negative: sum of Moderately and Very Negative, number per pen; 12 = Average stockperson time spent in the pen, seconds; 13 = Stockperson waving within pen, number per pen; 14 = Stockperson use of sorting board in pen, number per pen; 15 = Stockperson adjustment of feeding or watering equipment in pen, number per pen.
Partial correlations adjusted for treatment (ProHand and control) and Round (pre-training and post-training) model effects.

Coding: 1 = Salivary cortisol concentration, ng/ml; 2 = average number of pigs present in a video frame at 5 second intervals for each pen sampled; 3 = average time required per pig to collect salivary cortisol sample; 4 = Vocalizations, number per pen; 5 = Clapping, hand sounds, rattling sounds, number per pen; 6 = Physically pick up pigs, number per pen; 7 = Positive: patting or stroking pigs, number per pen; 8 = Neutral: tapping pigs or standing in the pen, number per pen; 9 = Moderately Negative: slaps and forceful pushes on pigs, number per pen; 10 = Very Negative: hitting and kicking pigs, number per pen; 11 = Total Negative: sum of Moderately and Very Negative, number per pen; 12 = Average stockperson time spent in the pen, seconds; 13 = Stockperson waving within pen, number per pen; 14 = Stockperson use of sorting board in pen, number per pen; 15 = Stockperson adjustment of feeding or watering equipment in pen, number per pen.

Table 12 (cont.) Pearson (upper) and partialb (in parentheses) correlations among stockperson (auditory, tactile, and pen activity) and pig measures (stroll, cortisol concentration, and time to gather salivary cortisol sample) for assessment of pig and human interaction effects (P < 0.05)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<td>(0.82)</td>
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</tbody>
</table>

`a`Partial correlations adjusted for treatment (ProHand and control) and Round (pre-training and post-training) model effects.

`b`Coding: 1 = Salivary cortisol concentration, ng/ml; 2 = average number of pigs present in a video frame at 5 second intervals for each pen sampled; 3 = average time required per pig to collect salivary cortisol sample; 4 = Vocalizations, number per pen; 5 = Clapping, hand sounds, rattling sounds, number per pen; 6 = Physically pick up pigs, number per pen; 7 = Positive: patting or stroking pigs, number per pen; 8 = Neutral: tapping pigs or standing in the pen, number per pen; 9 = Moderately Negative: slaps and forceful pushes on pigs, number per pen; 10 = Very Negative: hitting and kicking pigs, number per pen; 11 = Total Negative: sum of Moderately and Very Negative, number per pen; 12 = Average stockperson time spent in the pen, seconds; 13 = Stockperson waving within pen, number per pen; 14 = Stockperson use of sorting board in pen, number per pen; 15 = Stockperson adjustment of feeding or watering equipment in pen, number per pen.
<table>
<thead>
<tr>
<th>Variable&lt;sup&gt;b&lt;/sup&gt;</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
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<tbody>
<tr>
<td>(1) Salivary cortisol, ng/ml</td>
<td>0.39</td>
<td>0.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Time to collect cortisol, s/pig</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Pigs near observer at 5 s intervals, # pigs</td>
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<td>0.27</td>
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<tr>
<td>(4) Positive attitude toward pigs, subscale</td>
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<td>0.33</td>
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<tr>
<td>(5) Like to work with pigs, subscale</td>
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<td>(6) Characteristics of pigs, subscale</td>
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<td>(7) Pigs make good pets, subscale</td>
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<td>0.32</td>
<td>0.34</td>
</tr>
</tbody>
</table>

<sup>a</sup>1 = Salivary cortisol level, ng/ml; 2 = Time required per pig to collect salivary cortisol, seconds; 3 = Number of pigs present in a video frame at 5 second intervals for each pen sampled; 4 = Pigs are intelligent, require respect, feel pain like humans, and are excitable when moved forcefully subscale; 5 = Pigs are friendly, quite, and easy to work with subscale; 6 = Pigs are not gluttonous, dirty, smelly, greedy, ugly or stubborn subscale; 7 = Pigs are fun-loving, not simple-minded, and make good pets subscale.

<sup>b</sup>Subscale: 1 = Strongly Disagree with the statement, 3 = Neutral response to the statement, 5 = Strongly Agree with the statement.

Table 13. Correlations between stockperson responses to belief and attitudinal questions in the ProHand Pigs<sup>a</sup> training program and their relationships with direct measures of pig responses to human interactions.
<table>
<thead>
<tr>
<th>Variable(^a)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
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<th>(11)</th>
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</thead>
<tbody>
<tr>
<td>(1) Salivary cortisol, ng/ml</td>
<td>0.39</td>
<td>0.22</td>
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<td>0.27</td>
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</tr>
<tr>
<td>(2) Time to collect cortisol, s/pig</td>
<td>-0.28</td>
<td>-0.29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Pigs near observer at 5 s intervals, # pigs</td>
<td>-0.25</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Time spent with pigs when they are young is important</td>
<td>-0.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) Managing pigs is a greater priority than other farm responsibilities</td>
<td>0.26</td>
<td>0.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) Banging and loud noises are not necessary during daily observation</td>
<td></td>
<td>0.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7) Patting pigs while in the barn is good</td>
<td></td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>(8) Talking to pigs while in the barn is good</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>(9) Using a sorting board is necessary when moving or medicating pigs</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10) Using loud noises when loading for market is bad</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(11) Using sorting tools when loading for market is good</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(12) Electric prods should not be used when loading for market</td>
<td>0.28</td>
<td>0.32</td>
<td>-0.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(13) Use of tools, kicks, hits to get pigs up</td>
<td>0.27</td>
<td>0.35</td>
<td>0.32</td>
<td>0.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)1 = Salivary cortisol level, ng/ml; 2 = Time required per pig to collect salivary cortisol, seconds; 3 = Number of pigs present in a video frame at 5 second intervals for each pen sampled; 4-12 = Attitude and Belief Responses Subscales; 4 = It is important to spend more time with pigs when they are young subscale; 5 = Managing pigs is a greater priority than other farm, off-farm responsibilities subscale, 6 = Banging and loud noises are not necessary to rouse pigs for daily observation subscale; 7 = Patting pigs while in the barn is good subscale; 8 = Talking to pigs while in the barn is good subscale; 9 = Using a sorting board is necessary when moving or medicating pigs subscale; 10 = Using a loud voice or whistling when loading hogs for market is bad subscale; 11 = Using tools such as rattle paddles, sorting boards or pvc-pipes when loading hogs for market is good subscale; 12 = Electric prod should not be used when loading hogs for market subscale; 13 = Use of tools, kicks, hits to get pigs up

Table 14. Correlations between stockperson perceived behavioral control, their attitude toward the behavior, and the subsequent relationships with direct measures of pig responses to human interaction. (\(P \leq 0.10\))
<table>
<thead>
<tr>
<th>Variable</th>
<th>Variable</th>
<th>Variable</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Salivary Cortisol, ng/ml</td>
<td>(3) (6) (8) (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Time to collect Cortisol, s/pig</td>
<td>0.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Pigs near observer at 5 s intervals, # pigs</td>
<td>-0.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Little physical and verbal effort is needed to move pigs</td>
<td>0.23 0.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) Loading pigs for market requires slow and quiet movement with minimal use of electric prods</td>
<td>0.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) Pigs need enrichment in their pens</td>
<td>0.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7) Actions toward pigs influence the pig’s behavior</td>
<td>0.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(8) Pigs are perceived in a positive manner by humans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9) Feeding of Paylean® does not make pigs more excitable or more difficult to load for market</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 = Salivary cortisol level, ng/ml; 2 = Time required per pig to collect salivary cortisol, seconds; 3 = Number of pigs present in a video frame at 5 second intervals for each pen sampled; 4-9 = Attitude toward pigs responses subscales; 4 = Little physical and verbal effort is needed to move pigs subscale; 5 = Loading pigs for market requires slow and quiet movement with minimal use of electric prods subscale; 6 = Pigs need enrichment in their pens subscale; 7 = Actions toward pigs (speed of movement, entry into pens, actions within pens, and level of attention) influence the pig’s behavior subscale; 8 = Pigs are perceived as non-destructive, liking humans, and non-aggressive toward humans subscale; 9 = Feeding of Paylean® does not make pigs more excitable or more difficult to load for market subscale; 10 = Loading hogs for market is a pleasant experience subscale.*

Table 15. Correlations between stockperson attitudes toward pigs and relationships with direct measures of pig responses to human interactions. (P ≤ 0.10).
<table>
<thead>
<tr>
<th>Questionnaire&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Questionnaire&lt;sup&gt;b&lt;/sup&gt;</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Banging and loud noises are not necessary to rouse pigs for daily observation</td>
<td></td>
<td>Patting pigs while in the barn is good</td>
<td>Using a sorting board is necessary when moving or medicating pigs</td>
</tr>
<tr>
<td>Pigs are intelligent, require respect, feel pain like humans, and are excitable when moved forcefully</td>
<td>0.28</td>
<td></td>
<td></td>
<td>-0.22</td>
</tr>
<tr>
<td>Pigs are friendly, quite, and easy to work with</td>
<td>0.22</td>
<td>0.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pigs are not gluttonous, dirty, smelly, greedy, ugly or stubborn</td>
<td>0.31</td>
<td></td>
<td></td>
<td>0.28</td>
</tr>
</tbody>
</table>

Subscale: 1=Strongly Disagree with the statement, 3 = Neutral response to the statement, 5 = Strongly Agree with the statement

Table 16. Pearson Product Moment Correlations between: <sup>a</sup>Stockperson attitudes and beliefs about working in the pork industry, from the ProHand Pig training tool, <sup>b</sup>Stockperson attitudes and beliefs about working with pigs in their barn (P ≤ 0.10)
Table 17. Pearson Correlations between Stockperson attitudes and beliefs about working with pigs and pig characteristics. (P < 0.05).

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Walking through pens daily is good.</th>
<th>Time spent with pigs when they are young is important.</th>
<th>Loading hogs for market is bad.</th>
<th>Using a loud voice or whistling when loading hogs for market is bad.</th>
<th>Electric prod should not be used when loading hogs for market is bad.</th>
<th>Banging and loud noises are not necessary when moving or medicating pigs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeding of Paylean® does not make pigs more excitable or more difficult to load for market.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Pigs are perceived in a positive manner by humans.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Pigs need enrichment in their pens.</td>
<td>0.27</td>
<td>0.28</td>
<td>0.25</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Little physical and verbal effort is needed to move pigs.</td>
<td>-0.21</td>
<td>0.31</td>
<td>0.31</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Loading pigs for market requires slow and quiet movement with minimal use of electric prods.</td>
<td>-0.21</td>
<td>0.31</td>
<td>0.31</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Loading pigs for market is a pleasant experience.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Electric prod should not be used when moving or medicating pigs.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Time spent with pigs when they are young is important.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Loading hogs for market is bad.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Using a loud voice or whistling when loading hogs for market is bad.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Electric prod should not be used when loading hogs for market is bad.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Banging and loud noises are not necessary when moving or medicating pigs.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Pigs are perceived in a positive manner by humans.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Pigs need enrichment in their pens.</td>
<td>0.27</td>
<td>0.28</td>
<td>0.25</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Little physical and verbal effort is needed to move pigs.</td>
<td>-0.21</td>
<td>0.31</td>
<td>0.31</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Loading pigs for market requires slow and quiet movement with minimal use of electric prods.</td>
<td>-0.21</td>
<td>0.31</td>
<td>0.31</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Loading pigs for market is a pleasant experience.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Electric prod should not be used when moving or medicating pigs.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Time spent with pigs when they are young is important.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Loading hogs for market is bad.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Using a loud voice or whistling when loading hogs for market is bad.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Electric prod should not be used when loading hogs for market is bad.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Banging and loud noises are not necessary when moving or medicating pigs.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Pigs are perceived in a positive manner by humans.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Pigs need enrichment in their pens.</td>
<td>0.27</td>
<td>0.28</td>
<td>0.25</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Little physical and verbal effort is needed to move pigs.</td>
<td>-0.21</td>
<td>0.31</td>
<td>0.31</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Loading pigs for market requires slow and quiet movement with minimal use of electric prods.</td>
<td>-0.21</td>
<td>0.31</td>
<td>0.31</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Loading pigs for market is a pleasant experience.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Electric prod should not be used when moving or medicating pigs.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Time spent with pigs when they are young is important.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Loading hogs for market is bad.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Using a loud voice or whistling when loading hogs for market is bad.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Electric prod should not be used when loading hogs for market is bad.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Banging and loud noises are not necessary when moving or medicating pigs.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Pigs are perceived in a positive manner by humans.</td>
<td>-0.24</td>
<td>0.28</td>
<td>-0.31</td>
<td>0.31</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>Pigs need enrichment in their pens.</td>
<td>0.27</td>
<td>0.28</td>
<td>0.25</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Little physical and verbal effort is needed to move pigs.</td>
<td>-0.21</td>
<td>0.31</td>
<td>0.31</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Loading pigs for market requires slow and quiet movement with minimal use of electric prods.</td>
<td>-0.21</td>
<td>0.31</td>
<td>0.31</td>
<td>0.45</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Loading pigs for market is a pleasant experience.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Electric prod should not be used when moving or medicating pigs.</td>
<td>0.25</td>
<td>0.23</td>
<td>0.23</td>
<td>0.33</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>Questionnaire</td>
<td>Feeding of Paylean® does not make pigs more excitable or more difficult to load for market</td>
<td>Loading pigs for market requires slow and quiet movement with minimal use of electric prods</td>
<td>Loading pigs for market is a pleasant experience</td>
<td>Pigs need enrichment in their pens</td>
<td>Pigs are perceived in a positive manner by humans</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
<td></td>
</tr>
<tr>
<td>Pigs are intelligent, require respect, feel pain like humans, and are excitable when moved forcefully</td>
<td>0.21</td>
<td>0.36</td>
<td>0.27</td>
<td>0.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pigs are friendly, quiet, and easy to work with</td>
<td></td>
<td></td>
<td></td>
<td>0.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pigs are fun-loving, not simple-minded, and make good pets</td>
<td>0.37</td>
<td>0.21</td>
<td>0.21</td>
<td>0.23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Subscale: 1 = Strongly Disagree with the statement, 3 = Neutral response to the statement, 5 = Strongly Agree with the statement

Table 18. Pearson Product Moment Correlations between: aStockperson attitudes and beliefs about working in the Pork Industry, from the ProHand Pig training tool, bStockperson attitudes and beliefs about pigs and pig their characteristics. (P ≤ 0.10)
REFERENCES


Morrison, R. S., L. J. Johnston, A. D. Hilbrands. 2007. The behavior, welfare, growth performance and meat quality of pigs housed in a deep-litter, large group housing system compared to a conventional confinement system. Applied Animal Behavior Science. 103: 12-24


REFERENCES


Morrison, R. S., L. J. Johnston, A. D. Hilbrands. 2007. The behavior, welfare, growth performance and meat quality of pigs housed in a deep-litter, large group housing system compared to a conventional confinement system. Applied Animal Behavior Science. 103: 12-24


APPENDIX A: STOCKPERSON LOG
# Stockperson Log

**Instructions:**
To be completed each time any person enters or leaves the barn. Do this for 1 week.

<table>
<thead>
<tr>
<th>Date</th>
<th>Name</th>
<th>Time In</th>
<th>Time Out</th>
<th>Inspect only (from aisle)</th>
<th>Walk through pens</th>
<th>Check feeders/waterers</th>
<th>Medicate pigs (individually)</th>
<th>Euthanize or remove pigs</th>
<th>Other (example: medicating the water supply, fixing an auger)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/3/10</td>
<td>SMC</td>
<td>7:40 am/pm</td>
<td>9:17 am/pm</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>Repaired door, added medication to water supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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