

## Pre-Weaning Mortality in Pig-Causes and Management

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### Abstract

Data from the National Animal Health Monitoring System (NAHMS, 2001) indicate that the average number of pigs born per sow is 10.9, of which 10.0 are born alive and only 8.9 are able to survive until weaning. This results in a 11% pre-weaning mortality rate. In comparison, NAHMS data from 1990 and 1995 respectively indicate that the number of pigs born alive was 9.9 and 9.5, with 8.4 and 8.6 piglets weaned per litter. So, although we saw a decrease in pre-weaning mortality between 1990 and 1995, we show a slight increase from 9% to 11% between 1995 and 2000. Because average litter size has slowly increased, we have been able to realize a slow increase in the number weaned from 1990, 1995, and 2000; resulting in 8.4, 8.6, and currently 8.9 pigs weaned per litter. The NAHMS 2000 data indicate that of the 11% pre-weaning mortality, 52.1% die from becoming crushed by the sow, 16.7% die from starvation, 11.5% die from "other known problem", 9.3% die from scours, 7.4% from "unknown problem", and 3% from respiratory problems. The majority of pigs are weaned at 17.2 days of age, with an average of 19.3 days of age.

**Keywords:** Mortality, Pig, Pre-weaning, Management, Sow, Starvation, Scour.

### Complex Interaction of Pre-Weaning Mortality Causes

Although the above data indicate that pre-weaning mortality is attributed to very discrete causes, in reality piglets typically die from an interaction of several possible causes of death. For instance, research has shown that small piglets are more susceptible to cold and therefore will lie more closely to their dam to obtain warmth. In this situation it is easy to see that a piglet such as this may be more likely to become crushed due to its proximity to its dam. Similarly, piglets that miss a meal due to being sick, injured, outcompeted at the udder, or simply sleeping through a nursing bout, can enter an irreversible spiral in which they become weaker, miss the next meal, and so on until finally they starve to death. Therefore, although the cause of death may be listed as 'starvation', in reality it was a combination of size, ability to maintain a constant thermal status, a loud farrowing environment (possibly responsible for the pig missing the nursing bout), and pathogens in the environment that all contributed to the pigs death. Because of these complex interactions surrounding almost all cases of pre-weaning mortality, pre-weaning mortality has continued to hover around 10% for many years.

### Parturition

The process of birth is the first area of concern

in trying to decrease pre-weaning mortality. The above mentioned data indicate that .9 pigs per litter are born dead. Most of these deaths are due to still births while the remaining are mummified fetuses which can be due to either disease or intrauterine competition. As litter size increases, so does the number of stillbirths. In part this is due to an increase in the length of parturition. As the length of parturition increases, it is more likely that a piglet will be subjected to a state of hypoxia (lack of oxygen). Not only can this kill the piglet prior to birth but it also leads to piglets that are born with a reduced viability. These piglets may then be more likely to starve, become crushed, or diseased. In addition, as piglets are delivered at a larger birth weight, length of parturition increases, and likewise the chance of becoming hypoxic. Having larger litters can also increase pre-weaning mortality by contributing to a large within-litter variation in piglet weight, thus allowing some piglets to out-compete their siblings—causing them to starve or to become crushed.

### Thermal Stress

One of the most significant stressors a pig experiences upon birth is the challenge to adapt to the thermal environment. Unlike many mammals, piglets do not possess brown adipose tissue, a type of fat that enables newborn animals to generate a great deal of heat to maintain body temperature. This fact,

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combined with very little subcutaneous fat and a lack of a significant hair coat, ill-prepares the piglet to enter a cold environment. Thus the piglet is required to stay close to the dam or a heat source to avoid hypothermia. The shivering response is used as a back up response for the piglet to generate heat in a cold environment; however, if the piglet has been subjected to this much cold stress, it is already too much, and likely to cause pigs to become susceptible to disease, starvation, and crushing. The dam's belly provides an excellent heat source for the newborn pig but positions it in a location in which it may easily become crushed; without an adequate substitute heat source crushing rates can be very high. The use of heat lamps has helped dramatically to move the pigs away from the belly of the sow and into a safe area to avoid crushing. Unfortunately, the piglets attraction to the heat lamp is not solidified until approximately day three after birth. It is during these first three days after parturition that most pre-weaning deaths occur. During the first three days after birth, piglets have a high attraction to the dams udder and relatively little attraction to the heat lamp. Research has shown that by transferring the odor of the dam to an area under the heat lamp the more piglets can be drawn to this safe area. More research on how to attract piglets into a safe area can help to reduce pre-weaning mortality.

As with the other causes of piglet mortality, thermal stress has complex interactions with many factors. For instance, small piglets are more susceptible to hypothermia because of their surface to body volume ratio. This coupled with the fact that they are often outcompeted at the udder predisposes them to starvation which can in turn predispose them to become crushed. In addition, breed differences in tolerance to cold stress have been noted. The Meishan, a breed imported from China, produces piglets that are more resistant to cold stress than are Large Whites. This difference is not due to the piglets possessing more fat or being larger, they are actually much smaller, but due to the sow producing milk that has much greater concentration of fat than does the Large White. This higher caloric diet allows the Meishan piglet to produce more metabolic heat, and therefore better withstand hypothermia.

#### Nutrition

Obviously, adequate milk production by the sow is critical for proper nutrition of the piglets. As litter size increases it is important not to lose track of this insight. Larger litters require a much greater rate of milk production by the sow to ensure survival of the entire litter. Increasing the quality of the milk that is produced is also a viable strategy to increase nutrient availability to the piglet. Research has shown that increasing the

dietary fat of the sow during late gestation and early lactation can increase the fat content of the colostrum and thus increase survival of low birth weight pigs. This is due to the fact that increasing concentrations of colostral fat increases the piglets' energy intake and therefore fat deposition. Total intake of colostrum, however, is decreased. Another important factor in providing quality milk for the piglets is to maintain an environment that allows the sow to maximize feed intake. Environmental and disease stressors can both contribute to decreasing sow feed intake. Heat stress is especially capable of depressing feed intake. This poses a difficult situation as the producer must balance the needs of the piglet for a warm environment, with that of the sow for a much cooler environment.

#### Disease

Although the majority of pre-weaning losses are due to non-infectious causes which are strongly associated with management practices, deaths due to disease do occur and can be quite devastating. As with all mammals, the piglet is immunologically naïve at birth and depends on the transfer of maternal antibodies to provide it protection against disease. Therefore ingestion of colostrum, the immunoglobulin-rich milk that is produced maximally by 12 hours after parturition, is critical for piglet survival. After 48 hours of life, the piglet gut is no longer able to absorb these protective immunoglobulins. By 10 days of age the piglet is able to produce its own antibodies and this provides an overlap from the protection of the maternal antibodies which persist for approximately 14 days. Any factor that decreases colostrum intake, such as cold stress, can therefore predispose the neonate to succumb to disease due to its lack of protection. Birth order can also influence the amount of immuno-globulins a piglet receives. Because immunoglobulin content of the colostrum drops by 50% within 6 hours of the initiation of parturition, sows having larger litters and therefore a longer farrowing duration may predispose their last born piglets to receive a lower level of passive immunity. The endemic pathogen status of the sow herd can also influence whether piglets are struck with disease. Both bacterial and viral diseases are more likely in neonatal piglets that are born to infected sows.

#### The Sow and the Pig

Because more than 50% of pre-weaning mortality is due to being overlain by the sow, it is critical to examine sow maternal behavior. Researchers have found that piglets are crushed when the sow changes position, essentially moving between lying and standing and vice versa. However, pen housed sows

also crushed a significant amount of piglets while changing lying positions. Interestingly, evidence exists to suggest that early experience affects maternal ability, as sows reared in group-housing systems have been found to exhibit a lower piglet mortality rate. Sows are capable of exhibiting beneficial maternal behavior, and confinement has been shown to prevent their natural “anti-piglet crushing” behavioral repertoire thus suggesting a reason for the variable success of crates.

An outstanding anomaly in the piglet mortality problem is that the majority of sows do not respond to the distress vocalizations of their piglets when they are being crushed. However, sows which are responsive to piglet distress calls are better able to release trapped piglets prior to crushing. One theory to explain the non-responsiveness is that sows in farrowing crates are subjected to the distress vocalizations of neighboring piglets, and regardless of their responses they can not make the neighboring piglet stop vocalizing and thus they learn to be non-responsive when piglets vocalize.

Housing methods to reduce crushing may have met with variable success largely because research efforts have concentrated on controlling and (or) altering the behavior of the sow and have largely ignored the piglets' role in crushing mortalities.

Another anomaly in pre-weaning piglet deaths is due to savaging of piglets by the sow. Savaging behavior is characterized by a sow that is overtly aggressive to her piglets, and may result in injury and death to a portion of the litter. In a comprehensive survey of commercial gilts, researchers evaluated the incidence of savaging and some factors that are correlated with this deleterious behavior. These data reveal that 5.3% of gilts expressed piglet directed aggression with 2.9% of these gilts fatally savaging at least one of their piglets. Aggressive behavior of gilts to their offspring resulted in 6% death loss and 14% of piglets were injured. Interestingly, these authors found that if the lights were left on in the farrowing house, a reduction in the incidence of savaging was realized.

Additionally, animals that savaged piglets as gilts were more likely to savage during their second parity. Data indicate that savaging sows are more fearful of humans and that sows that readily interacted with humans were non-savaging and more protective of their litters. Fear of the piglets, lack of experience during adolescence, and the pain associated with parturition, have all been implicated in savaging behavior, however, the definitive cause(s) of savaging remains elusive.

#### Facilities

The initial move to decrease piglet crushing consisted of confining the sow to a smaller pen than

was traditional. The incidence of crushing and related piglet mortality has significantly decreased since the popular adoption of the farrowing crate in the 1950s. Indeed, most studies have found that housing sows in a small pen, or farrowing crate, does decrease piglet mortality. This management practice gained momentum in the 1960's as more economic pressures were applied to the swine industry. Unfortunately, piglet crushing remains a problem for swine producers. Data from NAHMS indicates that the rate of piglet crushing has remained at a high, stable rate from 1991 to 2000.

The incidence of pre-weaning mortality continues to represent a significant source of economic loss to the swine industry. Interestingly, approximately 50% of these pre-weaning death losses occur during the first three days of life.

Many experiments have been conducted to investigate the effect of the design of the sow's housing during farrowing in reducing preweaning mortality. The typical farrowing crate of approximately 6 m x 2.2 m is the prevalent form of housing today, but animal well-being continues to stimulate interest in the farrowing pen. But, crate design has been found to influence piglet mortality as research has found more crushing in wide crates (64 cm wide) than in narrow crates (55 cm wide). Unfortunately, relatively little work has been conducted to determine the effect of gestation housing on subsequent piglet survival.

One major reason changes in pen sizes and shapes may not have been successful in decreasing crushing is because piglets are attracted to their dam's udder immediately upon birth and prefer to lie there the majority of time during the first three days after birth. After this initial three days, piglets are often seen using the heat lamp instead of the sow's udder. This change of preference for lying area may help the piglets avoid death due to crushing. Although the sow's housing environment has been shown to have a profound effect on piglet crushing, the physical constraints of the sow and the behavior of both the sow and piglet should not be overlooked.

#### Management Tips

The biggest, most important act a producer may do to decrease pre-weaning mortality is to have a stockperson present during farrowing. Concern and vigilance during this time ensures that struggling piglets find the udder and are able to consume adequate colostrum. In addition, piglets that would be crushed can be placed in a safe spot under the heat lamp until they are able to maneuver well and compete for a teat. Those pigs that appear less viable and need the extra time under the heat lamp can be taken care of to ensure that they do not become hypothermic. In addition, while attending the farrowing sow, attention

to her neighbors who may have already farrowed can help save their piglets as well.

The thermal environment is probably the second most critical aspect to which to attend. Ensuring that the sow is not too hot and that the piglets are plenty warm can be tricky. However, success in both areas will allow the sow to have a maximum feed intake which will provide the pigs with greater nutrition, and it will help the pigs combat the challenges of malnutrition and disease.

As always, a clean environment goes a long way in providing a disease free state for both the sow and the piglet. Sow health can not be overlooked. Unhealthy sows, lame sows, and sows with pressure sores are less likely to be adept at lying and responding to their piglets and thus have a higher incidence of crushing.

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