An Integrated Approach to Improve Whole Herd Pig Livability Through Research and Industry Collaboration

Introduction and Project Objectives

The Improving Pig Survivability project is a 5-year project encompassing research, education, and extension efforts with the goal of reducing overall mortality in the U.S. commercial swine industry. The project is funded by the National Pork Board and the Foundation for Food and Agriculture Research (FFAR). Team members represent multiple institutions including Iowa State University, Kansas State University, and Purdue University. The project is guided by an advisory board consisting of representation across a wide spectrum of the US swine industry and multiple research projects have been direct collaborations with producers and allied industry partners in a field setting. Research efforts in this project seek to identify factors contributing to swine mortality in commercial production, and to develop strategies and information that can be utilized to reduce mortality and maximize pig survivability.

The project has 4 primary objectives:

- **Specific Objective 1**: Evaluation of the management attitudes and economics associated with improving survivability in U.S. swine production.
- **Specific Objective 2**: Identification of putative mortality causes on U.S. sow farms with the development and implementation of targeted strategies to maximize survivability.
- **Specific Objective 3**: Reducing wean to finish mortality through the implementation of management strategies founded upon ongoing production research.
- **Specific Objective 4**: Develop nationally effective and sustainable extension, outreach and education resources and strategies to enable adoption and implementation of strategies that will reduce mortality in pork production.

Project Outcomes

Through the collaborations of the Pig Survivability project, a large number of resources have been generated and made available to different audiences including peer-reviewed publications, factsheets, short informational videos, and podcasts. Dissemination of information learned through this project through extension and training efforts are critical to maximize the impact of the research efforts.

Through the Pig Survivability project, there have been a total of:

- 11 undergraduate internships
- 20 graduate students trained
- 50+ undergraduates trained
- 37 peer-reviewed publications
- 40 abstracts/presentations at meetings
- 9 poster presentations
- 5 published proceedings
- 117 invited presentations
- 30 popular press and animal industry reports
- 26 factsheets covering wide array of topics (many available in both English and Spanish)
- 26 short informational videos (many available in both English and Spanish)
- 45 podcasts (PigX podcast)

- 2 economic decision tools (economic modeling of breed-to-wean and wean-finish mortality)

The International Conference on Pig Survivability was held October 27 and 28, 2021 in Omaha, Nebraska, at the Hilton Omaha. The conference's objective was to facilitate the discussion and dissemination of the most current information relative to sow, litter, weaned pig and grow-finish mortality. A total of 451 participants from 29 states, 5 countries representing 175 different swine operations and allied industry business attended.

As a key outcome of the project, nearly all resources are available at the Improving Pig Survivability website (www.piglivability.org).

Training Activities:

The project supported the training activities of many students and staff:

- Graduate Students
  - Objective 1
    - Blaire Todd-Master's student with Dr. Nick Gabler
    - Kayla Miller-PhD student with Dr. Nick Gabler
    - Erin Dolecheck -PhD student working with Dr. Lee Schulz
  - Objective 2 (sow)
    - Grace Moeller-Master's student working with Dr. Ken Stalder
    - Zoe Kiefer-Master's student working with Dr. Jason Ross
    - Jamie Studer- PhD student working with Dr. Jason Ross
    - Dr. Justin Brown – Post-doctoral veterinarian working with Dr. Chris Rademacher and Locke Karriker
    - Dr. Meredith Petersen- Post-doctoral veterinarian working with Dr. Chris Rademacher and Locke Karriker
    - Dr. Gabi Doughan- Post-doctoral veterinarian working with Dr. Chris Rademacher and Locke Karriker
    - Vishesh Bhatia – PhD student working with Dr. Jack Dekkers
  - Objective 2 (pre-weaning)
    - Larissa Shirley-Master's student working with Dr. Kara Stewart
    - Marcie Christianson-Master's student with Dr. Ken Stalder
    - Kiah Gourley-PhD student with Dr. Jason Woodworth
    - Julia Holen-PhD student working with Dr. Jason Woodworth
    - Emiline Sundman-Master's student working with Dr. Anna Johnson
    - Spenser Becker-PhD student working with Dr. Laura Greiner
  - Objective 3
    - Jordan Gebhardt-PhD student with Dr. Mike Tokach
    - Madie Wensley-PhD student with Dr. Mike Tokach
    - Edison Magalhaes-Master's student with Dr. Daniel Linhares
    - Dr. Megan Nickel – Post-doctoral veterinarian working with Dr. Chris Rademacher and Dr. Locke Karriker
- Summer Interns
  - Erika Johnson - The first undergraduate intern supported on this project worked throughout summer 2019. She focused on POP projects, but she

was also able to help with the Sow Transition project, Sow Induction project, and Extension activities.
    - Caitlyn Eickleberry – In summer of 2020, Caitlyn worked with Dr. Jason Woodworth at Kansas State University where she helped with various research and extension activities.
    - Mikayla Spinler - In summer of 2020, Mikayla worked with Dr. Nick Gabler at Iowa State University where she helped with various research and extension activities.
    - Alicia Denton – Alicia worked with Dr. Kara Stewart at Purdue summer of 2021 and conducted a third trial looking at the impacts of heat lamp placement and piglet management at the time of birth on piglet growth and survival to weaning. They supervised undergraduate workers, collected data, conducted assays, entered data and interpreted data. They also contributed significantly to additional trails being conducted in the research laboratory.
    - Alton Holstine – Alton worked with Dr. Kara Stewart at Purdue summer of 2021 and conducted a third trial looking at the impacts of heat lamp placement and piglet management at the time of birth on piglet growth and survival to weaning. They supervised undergraduate workers, collected data, conducted assays, entered data and interpreted data. They also contributed significantly to additional trails being conducted in the research laboratory.
    - Ty Kim – Ty worked with Dr. Mike Tokach at Kansas State University summer of 2021 where he helped with several field research projects managed by Madie Wensley.
    - Andrew Boschert – Andrew worked with Dr. Mike Tokach at Kansas State University summer of 2021 where he helped with several field research projects managed by Madie Wensley.
    - Grace deNeui – Grace worked with Dr. Nick Gabler at Iowa State University and Dr. Kara Stewart at Purdue University where she helped with multiple research projects and extension activities.
    - Abigail Statler – Abigail worked with Dr. Nick Gabler at Iowa State University and Dr. Kara Stewart at Purdue University where she helped with multiple research projects and extension activities.
    - Maeghan Petznick- Maeghan Petznick worked with Dr. Laura Greiner at Iowa State University where she helped with multiple research projects and extension activities managed by Stacie Matchan.
    - Ayva Bohr- Ayva Bohr worked with Dr. Laura Greiner at Iowa State University where she helped with multiple research projects and extension activities managed by Stacie Matchan.
- Many additional graduate or undergraduate students are assisting at research and commercial farms with data collection. The commercial trials give students a unique exposure to a commercial sow farm that many students do not otherwise get.
- Train the Trainer
    - SOP review and training of all Standard Nutrition sow farm managers by Kara Stewart. February 23, 2022.

Scholarly Outputs in Research and Extension

Peer Reviewed Manuscripts

1. Gebhardt, Jordan T., Mike D. Tokach, Steve S. Dritz, Joel M. DeRouchey, Jason C. Woodworth, Robert D. Goodband, and Steve C. Henry. 2020. Post-weaning mortality in commercial swine production I: Review of non-infectious contributing factors. Transl. Anim. Sci. 4:1-23. https://doi.org/10.1093/tas/txaa068.
2. Gebhardt, Jordan T., Mike D. Tokach, Steve S. Dritz, Joel M. DeRouchey, Jason C. Woodworth, Robert D. Goodband, and Steve C. Henry. 2020. Post-weaning mortality in commercial swine production II: Review of infectious contributing factors. Transl. Anim. Sci. 4:1-22. https://doi.org/10.1093/tas/txaa052.
3. Gourley, K.M., Swanson, A.J., Royall, R.Q., DeRouchey, J.M., Tokach, M.D., Dritz, S.S., Goodband, R.D., Hastad, C., Woodworth, J.C. 2020. Effects of Timing and Size of Meals Prior to Farrowing on Sow and Litter Performance. Trans. Anim. Sci. 4: 724-736. https://doi.org/10.1093/tas/txaa066.
4. Kiefer, Z.K., Koester, L.R., Showman, L., Studer, J.M., Chipman, A.L., Keating, A.F., Schmitz-Esser, S., Ross, J.W. 2021. Vaginal microbiome and serum metabolite differences in late gestation commercial sows at risk for pelvic organ prolapse. Scientific Reports 11:6189. PMID: 33731737. https://doi.org/10.1038/s41598-021-85367-3.
5. Kiefer, Z.K., Studer, J.M., Chipman, Adur, M.K., Mainquist-Whigham, C., Gabler, N.K., Keating, A.F., Ross, J.W. 2021. Circulating biomarkers associated with pelvic organ prolapse risk in late gestation sows. Journal of Animal Science. PMID: 34228800. https://doi.org/10.1093/jas/skab207.
6. Kiefer, Z.K., Koester, L.R., Studer, J.M., Chipman, A.C., Mainquist-Whigham, C., Keating, A.F., Schmitz-Esser, S., Ross, J.W. Vaginal microbiota differences associated with pelvic organ prolapse risk during late gestation in commercial sows. Biology of Reproduction. In Press https://doi.org/10.1093/biolre/ioab178.
7. Wensley, Madie R., Mike D. Tokach, Jason C. Woodworth, Robert D. Goodband, Jordan T. Gebhardt, Joel M. DeRouchey, and Denny McKilligan. 2021. Maintaining continuity of nutrient intake after weaning I: review of pre-weaning strategies. Transl. Anim. Sci. 5:1-12. https://doi.org/10.1093/tas/txab021
8. Wensley, Madie R., Mike D. Tokach, Jason C. Woodworth, Robert D. Goodband, Jordan T. Gebhardt, Joel M. DeRouchey, and Denny McKilligan. 2021. Maintaining continuity of nutrient intake after weaning II: review of post-weaning strategies. Transl. Anim. Sci. 5:1-16. https://doi.org/10.1093/tas/txab022
9. Magalhaes, E.S. et al. Whole-herd drivers of wean-to-finish mortality under the conditions of a Midwestern USA swine production system. Preventive Veterinary Medicine. 198:105545. doi: 10.1016/j.prevetmed.2021.105545
10. Holen, Julia P., Jason C. Woodworth, Mike D. Tokach, Robert D. Goodband, Joel M. DeRouchey, and Jordan T. Gebhardt. 2021. Evaluation of Supplemental Fat Sources and Pre-Farrow Essential Fatty Acid Intake on Lactating Sow Performance and Essential Fatty Acid Composition of Colostrum, Milk, and Adipose Tissue. Kansas Agricultural Experiment Station Research Reports: Vol. 7: Iss. 11. https://doi.org/10.4148/2378-5977.8170.
11. Wensley, Madie R., Mike D. Tokach, Robert D. Goodband, Jordan T. Gebhardt, Jason C. Woodworth, Joel M. DeRouchey, Matt Allerson, Mariana Menegat, and Andy Boeschert. 2021. Effect of Floor Feeding Creep Feed on the Growth Performance and Mortality of Pigs After Weaning. Kansas Agricultural Experiment Station Research Reports: Vol. 7: Iss. 11. https://doi.org/10.4148/2378-5977.8166.

12. Wensley, Madie R., Ty Kim, Mike D. Tokach, Robert D. Goodband, Jason C. Woodworth, Joel M. DeRouchey, Denny McKilligan, Nathan Upah, and Jordan T. Gebhardt. 2021. Effects of Providing a Liquid Sensory Attractant to Suckling Pigs in Lactation and After Weaning on Post-Weaning Pig Performance. Kansas Agricultural Experiment Station Research Reports: Vol. 7: Iss. 11. https://doi.org/10.4148/2378-5977.8167.
13. Wensley, Madie R., Mike D. Tokach, Robert D. Goodband, Jordan T. Gebhardt, Jason C. Woodworth, Joel M. DeRouchey, Denny McKilligan, and Nathan Upah. 2021. Effects of Providing Enrichment Cubes to Suckling Pigs in Late Lactation and After Weaning on Post-Weaning Pig Performance. Kansas Agricultural Experiment Station Research Reports: Vol. 7: Iss. 11. https://doi.org/10.4148/2378-5977.8168.
14. Wensley, M. R., Mike D. Tokach, Robert D. Goodband, Jordan T. Gebhardt, Jason C. Woodworth, Joel M. DeRouchey, Denny McKilligan, and Nathan Upah. 2021. Effects of Providing a Sensory Attractant Powder to Suckling Pigs in Late Lactation and After Weaning on Post-Weaning Pig Performance. Kansas Agricultural Experiment Station Research Reports: Vol. 7: Iss. 11. https://doi.org/10.4148/2378-5977.8169.
15. Wensley, Madie R., Mike D. Tokach, Robert D. Goodband, Jordan T. Gebhardt, Jason C. Woodworth, Joel M. DeRouchey, Matt Allerson, and Mariana Menegat. 2021. Effects of Mat Feeding on the Growth Performance and Mortality of Pigs After Weaning. Kansas Agricultural Experiment Station Research Reports: Vol. 7: Iss. 11. https://doi.org/10.4148/2378-5977.8179.
16. Magalhães ES, Zimmerman JJ, Thomas P, Moura CAA, Trevisan G, Holtkamp DJ, Wang C, Rademacher C, Silva GS, Linhares DCL. Whole-herd risk factors associated with wean-to-finish mortality under the conditions of a Midwestern USA swine production system. Prev Vet Med. 2021 Nov 19;198:105545. doi: 10.1016/j.prevetmed.2021.105545. Epub ahead of print. PMID: 34801793.
17. Sundman, Emiline R., Nicholas K. Gabler, Suzanne T. Millman, Kenneth J. Stalder, Locke A. Karriker, and Anna K. Johnson. 2022. "The Use of Attractants to Stimulate Neonatal Piglet Interest in Rope Enrichment" Animals 12, no. 2: 211. https://doi.org/10.3390/ani12020211.
18. Julia P Holen, Jason C Woodworth, Mike D Tokach, Robert D Goodband, Joel M DeRouchey, Jordan T Gebhardt, Ashley E DeDecker, Xochitl Martinez, Evaluation of essential fatty acids in lactating sow diets on sow reproductive performance, colostrum and milk composition, and piglet survivability, Journal of Animal Science, 2022;, skac167, https://doi.org/10.1093/jas/skac167.
19. Wensley, Madie R., Megan L. Potter, Mike D. Tokach, Jason C. Woodworth, Robert D. Goodband, Joel M. DeRouchey, Jordan T. Gebhardt, Mariana B. Menegat, and Matt W. Allerson. 2022. Effects of mat feeding on the growth performance and morbidity and mortality of pigs after weaning. J. Anim. Sci. 100:1-7 Skac344. https://doi.org/10.1093/jas/skac344.
20. Julia P. Holen, Jason C. Woodworth, Mike D. Tokach, Robert D. Goodband, Joel M. DeRouchey, and Jordan T. GebHardt. Evaluation of spplemental fat sources and pre-farrow essential fatty acid intake on lactating sow performance and essential fatty acid composition of colostrum, milk, and adipose tissue. , Journal of Animal Science 101:1-12, 2022; skac 394. https://doi.org/10.1093/jas/skac394
21. Wensley, M.R., M.D. Tokach, J.C. Woodworth, R.D. Goodband, J.M. DeRouchey, and J.T. Gebhardt. 2023. Feeding strategies to increase sow colostrum quality and yield. J. Swine Health Prod. (accepted).

22. Wensley, M.R., M.D. Tokach, J.C. Woodworth, R.D. Goodband, J.M. DeRouchey, and J.T. Gebhardt. 2023. Nutritional strategies to reduce the impact of E. coli in newly weaned pigs. J. Swine Health Prod. (accepted).
23. Wensley, M.R., M.D. Tokach, J.C. Woodworth, R.D. Goodband, J.M. DeRouchey, and J.T. Gebhardt. 2023. Strategies to minimize fallback pigs in the nursery. J. Swine Health Prod. (accepted).
24. Wensley, Madie R., Mike D. Tokach, Jason C. Woodworth, Robert D. Goodband, Joel M. DeRouchey, and Jordan T Gebhardt. 2023. Effects of providing sensory attractants to suckling pigs during lactation and after weaning on post-weaning growth performance. Transl. Anim. Sci. Accepted for publication.
25. Bhatia, Vishesh, Tomas Stevens, Martijn F. L. Derks, Jenelle Dunkelberger, Egbert F. Knol, Jason W. Ross, and Jack C. M. Dekkers. 2023. Identification of the genetic basis of sow pelvic organ prolapse. Front. Genet. Vol. 14. https://doi.org/10.3389/fgene.2023.1154713.
26. Wensley, Madie R., Jason C. Woodworth, Mike D. Tokach, Robert D. Goodband, Joel M. DeRouchey, and Jordan T. Gebhardt. 2023. Effect of early vs. late maturing sire lines and creep feeding on the cortisol response, intestinal permeability, and growth performance of nursery and finishing pigs. J. Anim. Sci. 101:1-12. Skac 169. https://doi.org/10.1093/jas/skad169
27. Wensley, Madie R., Andrew W. Boschert, Ty H. Kim, Mike D. Tokach, Jason C. Woodworth, Robert D. Goodband, Joel M. DeRouchey, Jordan T. Gebhardt, and Ethan W. Stephenson. 2023. Effects of gruel feeding and oral dextrose on the survivability of pigs after weaning. Translational Anim. Sci. Volume 7, Issue 1 https://doi.org/10.1093/tas/txad082
28. Becker, S. L., D. C. Humphrey, L. A. Karriker, J. T. Brown, K. J. Skoland, and L. L. Greiner*#. The effects of dietary essential fatty acid ratios and linoleic acid on growth performance, lipid metabolism, and inflammation in grow-finish pigs. *J Anim Sci.* 2023. 10.1093/jas/skad151
29. Becker, S. L. and L. L. Greiner*#. The impact of essential fatty acid ratios and unsaturated to saturated fat ratio on growth performance of grow-finish pigs and estrus detection in gilts. *Transl Anim Sci.* 2023. https://doi.org/10.1093/tas/txad088.
30. Becker, S. L., D. C. Humphrey, L. A. Karriker, J. T. Brown, K. J. Skoland, and **L. L.** Greiner*#. The effects of dietary essential fatty acid ratios and energy level on growth performance, lipid metabolism, and inflammation in grow-finish pigs. *J Anim Sci.* 2023: skad151. https://doi.org/10.1093/jas/skad151.
31. Bhatia V, Stevens T, Derks MFL, Dunkelberger J, Knol EF, Ross JW and Dekkers JCM (2023) Identification of the genetic basis of sow pelvic organ prolapse. Front. Genet. 14:1154713. doi: 10.3389/fgene.2023.1154713
32. Bhatia, V., Schmied J., Cheng J., Bai X., Mallard B., Fortin F., Harding J. C. S., Dyck M. K., Plastow G. S., Field C. J., Rogel-Gaillard C., Blanc F., Canada P., & Dekkers J. C. M. (2022). 797. Genetic relationships among immune response traits of young healthy pigs evaluated by immunoassays. Proceeding of 12th World Congress on Genetics Applied to Livestock Production, 3282–3285. https://doi.org/10.3920/978-90-8686-940-4_797
33. Fortney, D. L. Biologically environment enrichment to improve nursery pig survivability. 2023. MS thesis.
34. Fortney, D. L., E. R. Sundman, N. K. Gabler, A. K. Johnson, K. J. Stalder, S. T. Millman and A. K. Johnson. 2023. Validation of scan sampling techniques for nursery pig feeder- and nutritional enrichment use. *Submitted as an Animal Industry Report.*

35. Fortney, D. L., E. R. Sundman, N. K. Gabler, S. T. Millman, and A. K. Johnson. 2024. Latency to feeder as a predictor of survivability in the weaning pig. To be submitted to Applied Animal Behavior.
36. Fortney, D. L., E. R. Sundman, N. K. Gabler, S. T. Millman, and A. K. Johnson. 2024. Nutritional enrichment to improve the weaning transition in nursery aged swine. To be submitted the Journal of Animal Behavior.
37. Fortney, D. L., E. R. Sundman, K. Buckova. N. K. Gabler, S. T. Millman, and A. K. Johnson. 2024. Review of current environmental enrichment in the swine industry and what is biologically relevant? To be submitted to the Journal of Swine Health and Production.

Abstracts Presented at Scientific Meetings

1. Tokach, M., Gebhardt, J., Dritz, S., Woodworth, J., DeRouchey, J., Goodband, R. Opportunities to enhance wean-to-finish pig survival. J. Anim. Sci. 98 (Suppl. 2): 394 (Abstr.).
2. Christianson, M. I., Stalder, K.J., Ramirez, A., Beitz, D.C., and Keating, A. Effect of genetic line and parity of dam on litter birth weight and weaning weight in swine. J. Anim. Sci. 98:(Abstr. in Press).
3. Becker, S. and L. Greiner. An investigation into the role of dietary essential fatty acids ratios and linoleic acid level on growth performance and inflammation of grow-finish pigs. J. Anim. Sci. 99 (Suppl. 1):204 (Abstr.).
4. Becker, S. and L. Greiner. An investigation into the role of dietary essential fatty acids ratios and energy level on growth performance, inflammation, and joint health of grow-finish pigs. J. Anim. Sci. 99 (Suppl. 1):206 (Abstr.).
5. Gourley, K., Swanson, A., Royall, R., Woodworth, J., DeRouchey, J., Tokach, M., Dritz, S., Milnes, K., and Hastad, C. Effects of Timing and Amount of Feed Prior to Farrowing on Sow and Litter Performance Under Commercial Conditions. J. Anim. Sci. 98 (Suppl. 1): 277 (Abstr.).
6. Kiefer, Z.E., Chipman, A.L., Studer, J.M., Koester, L.R., Showman, L., Schmitz-Esser, S., Keating, A.F., Ross, J.W. Identification of putative factors associated with pelvic organ prolapse in sows during late gestation. 52nd Annual Meeting of the Society for the Study of Reproduction, 2019.
7. Magalhaes, ES., Thomas, P., Moura, C A., Trevisan, G., Rademacher, C., Linhares, D C L. Whole-herd drivers of wean-to-finish mortality in a USA swine production system. 2019 Leman Conference; Sep 14-17, 2019; Pg 67.
8. Magalhaes, ES., Thomas, P., Moura, C A., Trevisan, G., Rademacher, C., Linhares, D C L. Health Status, Seasonality, and Site Information as Predictors of Mortality in a U.S Swine Production System. 2019 ISU James D. McKean Swine Disease Conference; Nov 7-9, 2019; Pg 32-34.
9. Sharp, K., Mills, L., Shirley, R., Garcia, R., Stewart, K.R. Impacts of various farrowing induction protocols on attended farrowing's. Midwest ASAS, 2020. (Abstr.).
10. Moeller, G., Stalder, K. Distribution of subjectively evaluated conformation traits in commercial growing replacement gilts. Midwest ASAS, 2020 (Abstr.).
11. Kiefer, Z.E., Studer, J.M., Chipman, A.L., Koester, L.R., Schmitz-Esser, S., Ross, J.W. Towards improving pig livability: strategies to understand and mitigate sow mortality. ASAS-CSAS, 2020. (Abstr.).

12. Kiefer, Z.E., Chipman, A.L., Studer, J.M., Gianluppi, R.D.F., Keating, A.F., Gabler, N.K., Ross, J.W. Steroid hormones are differentially abundant in sows with elevated risk for pelvic organ prolapse during late gestation. Midwest ASAS, 2020. (Abstr.).
13. Kiefer, Z.E., Studer, J.M., Chipman, A.L., Ross, J.W. Characterization of putative biomarkers in sows with elevated risk for pelvic organ prolapse during late gestation. 53nd Annual Meeting of the Society for the Study of Reproduction, 2020. Delivered Virtually.
14. Magalhaes, ES., Thomas, P., Moura, C A A., Trevisan, G., Rademacher, C., Linhares, DCL. Identifying parameters associated with wean-to-finish mortality in a swine production system. 2020 AASV Annual Meeting; Mar 7-10, 2020.
15. Magalhaes, ES., Thomas, P., Trevisan, G., Holtkamp, D., Rademacher, C., Zimmerman, JJ., Schwartz, L., Burrough, E., Linhares, D C L. Measuring the effect of disease diagnostic information on the mortality of growing pigs raised under field conditions. Annual Meeting American Association of Swine Veterinarians. Feb 27-Mar 4, 2021; Pg. 299-300.
16. Magalhaes, ES., Thomas, P., Trevisan, G., Schwartz, KJ., Linhares, D C L. Measuring the association of disease diagnostic data on wean-to-finish mortality of pigs marketed in a large US swine production system. Proceedings of the Allen D. Leman Swine Conference. Sep 14, 2020. Poster 53.
17. Magalhaes, ES., Thomas, P., Trevisan, G., Moura, C A A., Holtkamp, DJ., Rademacher, C., Zimmerman, JJ., Linhares D C L. Measuring the impact of sow farm risk factors on the wean-to-finish mortality of pigs under field conditions. Allen D. Leman Swine Conference; Sep 19-22, 2020; Pg 25; Saint Paul, MN - USA.
18. Allen D. Leman Swine Conference Survivability Pre-Conference Seminar (2020). Delivered Virtually.
    a. Gebhardt, J. Review of Post-Weaning Mortality in Commercial Production
    b. Kiefer, Z.E., Identifying Biological Factors Associated with Pelvic Organ Prolapse: Vaginal Microbiome
    c. Stewart, K.R. Best Practices of Colostrum Management
    d. Christianson, M. Effects of Breed, Parity, and Teat Location on Swine Colostrum Composition and Production Traits
    e. Magalhaes, E. Quantifying the Effect of Whole-Herd Health Parameters in Wean-to-Finish Survivability
    f. DeRouchey, J. Fact Sheets, Videos, and Other Resources Available Through the Project
19. Magalhaes, ES., Thomas, P., Moura, C A A., Trevisan, G., Holtkamp, DJ., Rademacher, C., Zimmerman, JJ., Linhares, D C L. Impact of health status and productivity of sow farms on subsequent wean-to-finish mortality. 2020 International Pig Veterinary Society Congress – IPVS 2020; Nov 3-6, 2020; Pg 468.
20. Z.E. Kiefer, A.L. Chipman, L. Showman, A.F. Keating, and J.W. Ross. Serum trace minerals in late gestation sows at variable risk for pelvic organ prolapse. The 2021 ASAS-ADSA Midwest Meeting in Omaha, NE. 2021. (Abstr.).
21. Magalhaes, ES., Rosero, S., Donovan, T., Thomas, P., Moura, CAA., Trevisan, G., Holtkamp, D., Zimmerman, JJ., Rademacher, C., Linhares, D C L. Consolidating diverse and disperse datasets to reveal production system-specific drivers of swine performance under field conditions. Annual Meeting American Association of Swine Veterinarians. Seminar # 3. Feb 27, 2021; Pg. 31-32.
22. Sundman, E.R., Gabler, N.K., Millman, S.T., Stalder, K.J., Karriker, L.A., Johnson, A.K.

"Nutritional enrichment to improve the welfare of nursery-aged swine at weaning". Merck's Advancing Animal Welfare Together (AAWT) Symposium, Orlando, FL (November 16, 2021).

23. Nickel, M., Rademacher, C., Skoland, K., Brown, J., Ruston, C., Kittrell, H., Karriker, L. (2021). Comparison of antibiotic treatment regimens for naturally occurring, multi-etiology disease challenges in a commercial nursery facility. Paper presented at the 52nd Annual Meeting of the American Association of Swine Veterinarians, Virtual.
24. Andrew W Boschert, Madie R Wensley, Mike D Tokach, Robert D Goodband, Jordan T Gebhardt, Jason C Woodworth, Joel M DeRouchey, Ethan Stephenson, PSI-2 Effect of Gruel Feeding and Oral Dextrose on the Survivability of Pigs After Weaning, Journal of Animal Science, Volume 100, Issue Supplement_2, May 2022, Page 201, https://doi.org/10.1093/jas/skac064.339.
25. Madie R Wensley, Mike D Tokach, Robert D Goodband, Jordan T Gebhardt, Jason C Woodworth, Joel M DeRouchey, Ethan Stephenson, PSII-13 Effect of Body Weight, Body Temperature, and Blood Glucose on the Survivability of Pull Pigs After Removal, Journal of Animal Science, Volume 100, Issue Supplement_2, May 2022, Page 135, https://doi.org/10.1093/jas/skac064.231.
26. Madie R Wensley, Mike D Tokach, Robert D Goodband, Jordan T Gebhardt, Jason C Woodworth, Joel M DeRouchey, Denny McKilligan, Nathan Upah, PSIII-19 Effect of Sensory Attractants Before and After Weaning on Nursery Pig Performance, Journal of Animal Science, Volume 100, Issue Supplement_2, May 2022, Pages 142–143, https://doi.org/10.1093/jas/skac064.243.
27. Kim, Ty, Madie R Wensley, Mike D Tokach, Robert D Goodband, Jordan T Gebhardt, Jason C Woodworth, Joel M DeRouchey, Denny McKilligan, Nathan Upah. 2022. Effects of Providing a Liquid Sensory Attractant to Suckling Pigs in Lactation and After Weaning on Post-Weaning Pig Performance, Journal of Animal Science, Volume 100, Issue Supplement_2, Pages 126–127, https://doi.org/10.1093/jas/skac064.215.
28. Wensley, Madison, Mike D. Tokach, Jason C. Woodworth, Jordan T. Gebhardt. Robert D. Goodband, and Joel M. DeRouchey. 2022. Young scholar award talk: Strategies to maintain nutrient intake, reduce weight loss, and improve livability in newly weaned pigs. J. Anim. Sci. 100, abstract 392.
29. Holen, Julia P, Jason C Woodworth, Mike D Tokach, Robert D Goodband, Joel M DeRouchey, Jordan T Gebhardt, Ashley DeDecker, Xochitl Martinez. 2022. Evaluation of Essential Fatty Acids in Lactating Sow Diets on Sow Reproductive Performance, Colostrum and Milk Composition, and Pre-Weaning Litter Growth and Survivability, Journal of Animal Science, Volume 100, Issue Supplement_2, Pages 22–23, https://doi.org/10.1093/jas/skac064.036.
30. Holen, Julia P, Jason C Woodworth, Mike D Tokach, Robert D Goodband, Joel M DeRouchey, Jordan T Gebhardt, Ashley DeDecker, Xochitl Martinez. 2022. Evaluating the Impact of Essential Fatty Acids in Lactation Diets on Sow and Litter Performance, Journal of Animal Science, Volume 100, Issue Supplement_2, Page 112, https://doi.org/10.1093/jas/skac064.190.
31. Spenser Becker, Laura L Greiner, PSVII-8 The Impact of Dietary Essential Fatty Acids Ratios and Unsaturated: Saturated Ratio on Growth Performance of Grow-Finish Pigs, Journal of Animal Science, Volume 100, Issue Supplement_2, May 2022, Pages 170–171, https://doi.org/10.1093/jas/skac064.290.
32. Magalhaes, ES., Trevisan, G., Holtkamp, D., Zimmerman, JJ., Silva, GS., Linhares, D C L. Consolidating production, management and health data from all phases of production

to assess the causes of wean-to-finish mortality. 2022 International Pig Veterinary Society Congress – IPVS 2022; June 21-24, 2022; Pg 575.

33. Magalhaes, ES., Thomas, P., Trevisan, G., Holtkamp, D., Rademacher, C., Zimmerman, JJ., Schwartz, L., Burrough, E., Linhares, D C L. Application of aggregated histopathology data to assess disease impact in growing pig populations. 2022 International Pig Veterinary Society Congress – IPVS 2022; June 21-24, 2022; Pg 506.
34. Z.E. Kiefer, L.R. Koester, J.M. Studer, C. Mainquist-Whigham, S. Schmitz-Esser, and J.W. Ross. Evaluation of the Fecal Microbiota in Commercial Sows with Variable Risk for Pelvic Organ Prolapse During Late Gestation. The 2022 ASAS-ADSA Midwest Meeting in Omaha, NE. 2022.
35. Z.E. Kiefer, L.R. Koester, J.M. Studer, S. Schmitz-Esser, and J.W. Ross. 2022. Correlations between vaginal and fecal microbiota in commercial sows with variable risk for pelvic organ prolapse during late gestation. 55nd Annual Meeting of the Society for the Study of Reproduction. Spokane, WA, USA.
36. Dunkelberger J.R., T. Stevens, V. Bhatia, J. W. Ross, J. C. M Dekkers, and E. F. Knol. 2023. Breeding robust sows for commercial conditions. Leman Swine Conference – presentation
37. Bhatia, V., and J. C. M. Dekkers. 2023. Genetic Basis of Sow Pelvic Organ Prolapse. National Hog Farmer.
38. Bhatia, V., and J. C. M. Dekkers. 2023. Sow pelvic organ prolapse appears to have genetic, environmental basis. Feedstuffs in Focus Podcast
39. Bhatia V, Stevens T, Derks MFL, Dunkelberger J, Knol EF, Ross JW and Dekkers JCM. 2023. Genomic Regions Associated with susceptibility to Sow Pelvic Organ Prolapse. Plant and Animal Genome 30 – poster
40. Bhatia V, Stevens T, Derks MFL, Dunkelberger J, Knol EF, Ross JW and Dekkers JCM. 2023. Identification of the Genetic Basis of Sow Pelvic Organ Prolapse. Iowa Pork Congress

Poster Presentations

1. Magalhaes, ES. "Measuring the association of disease diagnostic data on wean-to-finish mortality of pigs marketed in a large US swine production system." Proceedings of the Allen D. Leman Swine Conference. Poster 53. September 14, 2020.
2. "Use of biologically relevant enrichment to improve nursery-aged pig weaning transition" by Alexandria Geary. Honors project. December 8, 2021.
3. "Sow performance association with body condition measured prior to and after farrowing" by William Taylor. Iowa Pork Congress. January 26-27, 2022.
4. "Use of biologically relevant enrichment to improve the weaning transition of nursery-aged swine" by Emiline Sundman. Senior Honors Project, Iowa State University Honors Poster Presentation. February 2, 2022.
5. "Effects of novel nutritional enrichment on pig feeder aggression during early weaning" by Emiline Sundman. Senior Honors Project, Iowa State University Honors Poster Presentation. February 2, 2022.
6. "Effect of gruel feeding and oral dextrose on the survivability of pigs after weaning" by Andrew Boschert. American Society of Animal Science Midwest Meeting. March 14, 2022.
7. "Effect of body weight, body temperature, and blood glucose on the survivability of cull pigs after removal" by Madie Wensley. American Society of Animal Science Midwest Meeting. March 14, 2022.

8. “Effect of sensory attractants before and after weaning on nursery pig performance” by Madie Wensley. American Society of Animal Science Midwest Meeting. March 14, 2022.
9. “Confirmation of the Genetic Basis of Sow Pelvic Organ Prolapse (POP) Using Genomic Data” by Vishesh Bhatia. Allen D. Leman Swine Conference. September 17-20, 2022.

Published Proceedings

1. Kiefer, Z.E., Chipman, A.L., Studer, J., Johnson, C., Rademacher, C.J., Linhares, D.C.L., Ross, J.W. 2019. Update on Prolapses and Pig Survivability Initiative. James D. McKean Swine Disease Conference. Ames, Iowa. November 7-8.
2. Schulz, L.L. Sensitivity Analysis of Net Returns to Mortality. Pre-Conference Seminar: Raising Pigs for Dummies (Keep them Alive). Proceedings of the 52nd Annual Meeting of the American Association of Swine Veterinarians.
3. Economics of Mortality- With a Look at Decision Tools to Help Improve it. 2023 Banff Pork Seminar Proceedings. January 11, 2023.
4. Gebhardt, J., S. Matchan, J. Ross, J. Dekkers, S. Canavate, C. Rademacher, C. Johnson, M. Tokach, E. Magalhaes, J. Woodworth, and J. DeRouchey. 2023. Improving pig survibility through research and collaboration. Proceedings of the 54th Annual Meeting of the American Association of Swine Veterinarians.
5. American Association of Swine Veterinarians (AASV) Annual Meeting Pre-Conference Seminar (2024), Nashville TN.
    a. Tokach, M. Early gut development, feeding, management practices to maximize livability
    b. Doughan, G Water line biology and considerations for pig livability.
    c. Mendoza, O. Recent research findings focused on wean-finish survivability.
    d. Magalhaes, E. Identification of drivers of mortality, identifying action items, and economic outcomes.
    e. Benge, N. Improving sow livability with individual sow care and husbandry.
    f. Burton, B. A focus on sow care to maximize systemic livability.
    g. Haden, C. First hand experiences and lessons learned with pre-weaning mortality.
    h. Rosa, G. Addressing pig mortality through understanding of transportation losses.
    i. Gebhardt, J. Key findings of the pig livability project.

Invited Presentations

1. “An integrated approach to improve whole herd pig survivability. National Pork Board Webex Webinar, August 27th, 2019.
2. “Current efforts towards improving pig livability.” Allen D. Leman Swine Conference. Minneapolis, MN. September 16th, 2019.
3. “An industry-wide approach to better understand the putative causes of pelvic organ prolapse in sows”. Zoetis Technical Service Team Webinar, September 20th, 2019.
4. Magalhaes ES. “Investigating wean-to-finish causes of mortality.” Leman Conference. Brazilian Symposium (session in Portuguese). Saint Paul, MN. September 2019.
5. “An industry-wide approach to better understand the putative causes of pelvic organ prolapse in sows” Medicated Feed Additive Expert Council. Des Moines, IA. October 22nd, 2019.
6. “An industry-wide approach to better understand the putative causes of pelvic organ prolapse in sows” North Carolina Veterinary Medical Association Swine Veterinary Conference. Raleigh, NC, November 1st, 2019.

7. Magalhaes ES. “Drivers of wean-to-finish mortality and the impact of disease status.” 2019 North American PRRS Symposium. Chicago, Illinois. November 2019.
8. “An update on prolapses and the pig survivability initiative”. Iowa State University James D. McKean Swine Disease Conference. Ames, IA, November 8th, 2019.
9. Magalhaes ES. “Health Status, Seasonality, and Site Information as Predictors of Mortality in a U.S Swine Production System.” James D. McKean Swine Disease Conference. Ames, Iowa. November 2019.
10. “Update on Prolapses and Pig Survivability Initiative” Online Webinar for the Nutriquest Technical Team. December 4th, 2019.
11. “The importance of colostrum.” National Swine Improvement Federation Annual Meeting. Indianapolis, IN. December 5-6th, 2019.
12. “Distribution of subjectively evaluated conformation traits in commercial growing replacement gilts” Midwest ASAS, Omaha, NE. March 3, 2020.
13. “Steroid hormones are differentially abundant in sows with elevated risk for pelvic organ prolapse during late gestation” Midwest ASAS Meeting, Omaha, NE. March 3, 2020.
14. “An industry-wide approach to better understand pelvic organ prolapse in sows”. American Association of Swine Veterinarians Annual Meeting. Atlanta, GA. March 8th, 2020.
15. “Towards improving pig livability: Strategies to understand and mitigate sow mortality”. American Society of Animal Science Annual Meeting. Virtual Presentation, July 22, 2020.
16. “Opportunities to enhance wean-to-finish pig survival”. American Society of Animal Science Annual meeting. July 22, 2020.
17. Gebhardt, J. “Review of Post-Weaning Mortality in Commercial Production”. Allen D. Leman Swine Conference Survivability Pre-Conference Seminar. September 19, 2020.
18. Magalhaes ES. “Quantifying the effect of whole-herd health parameters in wean-to-finish survivability.” 2020 Leman Conference. Survival Workshop: Updates and Resources from the Improving Pig Survivability Project. September 19-22, 2020.
19. : Vaginal Microbiome”. Allen D. Leman Swine Conference Survivability Pre-Conference Seminar. September 19, 2020.
20. Stewart, K. “Best Practices of Colostrum Management”. Allen D. Leman Swine Conference Survivability Pre-Conference Seminar. September 19, 2020.
21. Christianson, M. “Effects of Breed, Parity, and Teat Location on Swine Colostrum Composition and Production Traits”. Allen D. Leman Swine Conference Survivability Pre-Conference Seminar. September 19, 2020.
22. Magalhaes, E. “Quantifying the Effect of Whole-Herd Health Parameters in Wean-to-Finish Survivability”. Allen D. Leman Swine Conference Survivability Pre-Conference Seminar. September 19, 2020.
23. DeRouchey, J. “Fact Sheets, Videos, and Other Resources Available Through the Project”. Allen D. Leman Swine Conference Survivability Pre-Conference Seminar. September 19, 2020.
24. “Survivability project updates.” Kansas State University Swine Industry Day. November 18, 2022.
25. Tokach, M. “Maintaining continuity of nutrient intake after weaning: Pre- and post-weaning strategies”. KSU Swine Day. November 19, 2020.
26. Feeding sows immediately before farrowing-What have we learned? Kansas State University Swine Day. November 19, 2020.
27. “Factors associated with pig livability in the post-weaning period” American Association of Swine Veterinarians 2021 Annual meeting. February 28, 2021.

28. Sensitivity Analysis of Net Returns to Mortality. Pre-Conference Seminar: Raising Pigs for Dummies (Keep them Alive). Invited presentation at the 52nd Annual Meeting of the American Association of Swine Veterinarians. February 28, 2021.
29. "Factors associated with pig livability in the post-weaning period". 2021 AASV Annual Meeting, virtual. February 28, 2021.
30. Tokach, M. "Preparing for a low zinc world" American Association of Swine Veterinarians National Meeting. March 1, 2021.
31. "An investigation into the role of dietary essential fatty acids ratios and linoleic acid level on growth performance and inflammation of grow-finish pigs". Midwest ASAS, Virtual Conference. March 2021.
32. Linhares, DCL. Revealing causal associations and forecasting productivity from consolidated datasets. September 20, 2021. Allen D. Leman Swine Conference. St. Paul, MN.
33. "Economics of Mortality." International Conference on Pig Survivability. October 27th, 2021.
34. "Success, failures and actions on post-weaning survivability." International Conference on Pig Survivability. October 27th, 2021.
35. "Sow survivability: Pelvic organ prolapse." International Conference on Pig Survivability. October 28th, 2021.
36. "Early identification and treatment of at-risk sows." International Conference on Pig Survivability. October 28th, 2021.
37. "Nutritional enrichment to improve the weaning transition in nursery aged pigs." International Conference on Pig Survivability. October 28th, 2021.
38. "Attempts to maintain feed intake and reduce weight loss after weaning." International Conference on Pig Survivability. October 28th, 2021.
39. "The use of attractants to stimulate neonatal piglet interest in rope enrichment." International Conference on Pig Survivability. October 28th, 2021.
40. "Impact of essential fatty acids in lactation diets on sow and litter performance." International Conference on Pig Survivability. October 28th, 2021.
41. "The effects of heat lamp placement on piglet mortality." International Conference on Pig Survivability. October 28th, 2021.
42. "Farrowing induction impacts on piglet viability and survival." International Conference on Pig Survivability. October 28th, 2021.
43. "Opportunities for measurable impact" International Conference on Pig Survivability. October 28th, 2021.
44. "Creating good lactating sows: how many meals pre-farrow is best." International Conference on Pig Survivability. October 28th, 2021.
45. "Assembling whole-herd data to reveal causal patterns and forecasting grow-finish survivability." International Conference on Pig Survivability. October 28th, 2021.
46. "Nutritional enrichment to improve the welfare of nursery-aged swine at weaning". Merck's Advancing Animal Welfare Together (AAWT) Symposium, Orlando, FL. November 16, 2021.
47. "Survivability project updates." Kansas State University Swine Industry Day. November 18, 2022.
48. "Pre-weaning mortality – opportunity for impact". National Swine Improvement Federation Annual Meeting, St. Louis, MO. November 30, 2021.
49. "Interventions to reduce mortalities: pre-weaning." SowBridge. December 1, 2021.
50. "Colostrum and managing the young pig." Iowa Pork Industry Center Sow Summit. December 8, 2021.

51. “Pelvic organ prolapse: research updates and future directions.” Iowa Pork Industry Center Sow Summit. December 8, 2021.
52. “Monitoring sow health and implementation of interventions.” Iowa Pork Industry Center Sow Summit. December 8, 2021.
53. “On farm strategy to impact sow mortality.” Iowa Pork Industry Center Sow Summit. December 8, 2021.
54. “Sow survivability.” Ohio Pork Congress. February 9, 2022.
55. “Piglet survivability.” Standard Nutrition sow farm managers meeting. February 23, 2022
56. “Technologies for farrowing efficiency and piglet survival.” ASAS Midwest Animal Science Annual Meeting. March 14, 2022.
57. “Effect of floor feeding creep feed on the growth performance and morbidity and mortality of pigs after weaning.” ASAS Midwest Animal Science Annual Meeting. March 14, 2022.
58. “Effect of mat feeding on the growth performance and morbidity and mortality of pigs after weaning.” ASAS Midwest Animal Science Annual Meeting. March 14, 2022.
59. “Effects of providing a liquid sensory attractant to suckling pigs in lactation and after weaning on post-weaning pig performance.” ASAS Midwest Animal Science Annual Meeting. March 14, 2022.
60. “Effect of gruel feeding and oral dextrose on the survivability of pigs after weaning.” ASAS Midwest Animal Science Annual Meeting. March 14, 2022.
61. “Evaluation of essential fatty acids in lactating sow diets on sow reproductive performance, colostrum and milk composition, and pre-weaning litter growth and survivability.” ASAS Midwest Animal Science Annual Meeting. March 14, 2022.
62. “Evaluating the Impact of Essential Fatty Acids in Lactation Diets on Sow and Litter Performance.” ASAS Midwest Animal Science Annual Meeting. March 14, 2022.
63. “Water and feed-based arginine impacts on gut integrity in weanling pigs.” ASAS Midwest Animal Science Annual Meeting. March 14, 2022.
64. “Evaluation of the fecal microbiota in commercial sows with variable risk for pelvic organic prolapse during late gestation.” ASAS Midwest Animal Science Annual Meeting. March 14, 2022.
65. “Body condition association with production records and feed management decisions.” ASAS Midwest Animal Science Annual Meeting. March 14, 2022.
66. “Farrowing induction and impacts on piglet survival.” Penn State Producer Meeting. March 29, 2022.
67. “Update on impact of structural conformation scores on survivability in stalled and group house gestation facilities.” Meeting with Iowa producer and genetics company. March 31, 2022.
68. “Neonatal piglet interaction with environmental enrichment ropes and impacts on mortality and litter weight gain.” North American International Society of Applied Ethology. April 2022.
69. “How can you improve livability in pig production.” Webinar. May 26, 2022.
70. “Economics of Nursery Mortality.” Zinpro Pre-World Pork Expo Meeting. June 7, 2022.
71. “Early identification of treatment of sows.” PIC. June 17, 2022.
72. “Early identification of treatment of sows.” International Pig Veterinary Society Congress. June 21, 2022.
73. “Young scholar award talk: Strategies to maintain nutrient intake, reduce weight loss, and improve livability in newly weaned pigs.” National ASAS meeting. June 29, 2022.
74. “Decision maker tools for improving mortality.” Iowa Swine Day. June 30, 2022.

75. “A practical approach to early intervention to reduce sow mortality.” Iowa Swine Day. June 30, 2022.
76. “Causes of and strategies to minimize post-weaning mortality in commercial swine production.” AMVEC pre-congress seminar. July 14, 2022.
77. “POP microbiota data comparing the vaginal and fecal communities.” Society for the Study of Reproduction Annual Meeting. July 26, 2022.
78. “POP risk factors.” Carthage Veterinary Service Swine Conference. August 23, 2022.
79. “Sow treatment.” Carthage Veterinary Service Swine Conference. August 23, 2022.
80. “Validation of scan sampling techniques for nursery pig feeder and enrichment use.” Congress of International Society of Applied Ethology. September 4-8, 2022.
81. “Importance of colostrum to the developing gilt.” Allen D. Leman Swine Conference Pre-Conference Sessions. September 17, 2022.
82. “Identifying at risk sows, a case control study.” Allen D. Leman Swine Conference Pre-Conference Sessions. September 17, 2022.
83. “Introduction and sow livability resources.” Allen D. Leman Swine Conference Sow Livability Seminar. September 19, 2022.
84. “Prolapses in sows- what we know, what has been done, where we go.” Allen D. Leman Swine Conference Sow Livability Seminar. September 19, 2022.
85. “Improved sow livability through refocused individual attention.” Allen D. Leman Swine Conference Sow Livability Seminar. September 19, 2022.
86. “What our system has done to improve sow livability.” Allen D. Leman Swine Conference Sow Livability Seminar. September 19, 2022.
87. “Economics of sow mortality - newly developed calculator.” Allen D. Leman Swine Conference Sow Livability Seminar. September 19, 2022.
88. “Discussion and take-home practices.” Allen D. Leman Swine Conference Sow Livability Seminar. September 19, 2022.
89. “Introduction and pre-wean, nursery and finishing livability resources.” Allen D. Leman Swine Conference Birth to Market Livability Seminar. September 20, 2022.
90. “Colostrum- how much can we move the needle.” Allen D. Leman Swine Conference Birth to Market Livability Seminar. September 20, 2022.
91. “What our system has done to improve wean-to-finish livability.” Allen D. Leman Swine Conference Birth to Market Livability Seminar. September 20, 2022.
92. “Improving livability through grow-finish biosecurity.” Allen D. Leman Swine Conference Birth to Market Livability Seminar. September 20, 2022.
93. “Economics of wean-to-finish mortality – a newly developed calculator.” Allen D. Leman Swine Conference Birth to Market Livability Seminar. September 20, 2022.
94. “Discussion and take-home practices.” Allen D. Leman Swine Conference Birth to Market Livability Seminar. September 20, 2022.
95. “Identification and Intervention for Reducing Sow Mortality.” Saskatchewan Pork Industry Symposium 2022. November 15, 2022.
96. “Effect of a small dose of colostrum provided at birth on newborn piglets’ behavior, growth and survival.” International Scientific Meeting on Colostrum. November 2022.
97. “Economics of Mortality – With a Look at Decision Tools to Help Improve it.” Piflet Management Breakout Session at 2023 Banff Pork Seminar. Banff, Alberta Canada. January 11, 2023.
98. “Introduction and overview of the Pig Survivability project.” American Association of Swine Veterinarians Annual Meeting. March 4, 2023.
99. “Overview of sow pelvic organ prolapse research.” American Association of Swine Veterinarians Annual Meeting. March 4, 2023.

100. "Is there a genetic basis for pelvic organ prolapse?" American Association of Swine Veterinarians Annual Meeting. March 4, 2023.
101. "Sow robustness: Key areas to maximize sow retention." American Association of Swine Veterinarians Annual Meeting. March 4, 2023.
102. "Early identification of at-risk sows reduces sow mortality." American Association of Swine Veterinarians Annual Meeting. March 4, 2023.
103. "Managing noninfectious causes of sow mortality." American Association of Swine Veterinarians Annual Meeting. March 4, 2023.
104. "Overview of nutritional, genetic, and management strategies to influence mortality after weaning." American Association of Swine Veterinarians Annual Meeting. March 4, 2023.
105. "Postweaning mortality: Key findings through data analysis." American Association of Swine Veterinarians Annual Meeting. March 4, 2023.
106. "Overview of available resources and producer tools." American Association of Swine Veterinarians Annual Meeting. March 4, 2023.
107. "Key Sow Mortality and Sow Herd Health Correlation Findings." National Hog Farmers Global Hog Industry Virtual Conference: Improving Pig Survivability Project. May 2023.
108. "Key Postweaning Nutrition & Management Findings and Educational Resources." National Hog Farmers Global Hog Industry Virtual Conference: Improving Pig Survivability Project. May 2023.
109. "Advancing Profits and Sustainability by Improving Pig Survivability." World Pork Expo. June 8, 2023.
110. "Identification and Intervention for Reducing Sow Mortality." National Pork Industry Conference. July 10, 2023
111. "Swine Education and Outreach Professionals- Q2 2023 Webinar: Improving Pig Survivability." National Pork Board. August 23, 2023.
112. Rademacher, C. "A Practical approach to early intervention to reduce sow mortality" Sow Bridge Educational Series. October 4. 2023.
113. Tokach, M. "Early life gut development, feeding, management practices to maximize livability" American Association of Swine Veterinarians National Meeting. February 24, 2024.
114. Doughan, G. "Water line biology and considerations for pig livability" American Association of Swine Veterinarians National Meeting. February 24, 2024.
115. Magalhaes, E. "Identification of drivers of mortality, identifying action items, and economic outcomes" American Association of Swine Veterinarians National Meeting. February 24, 2024.
116. Gebhardt, J. "Pig Livibility: What works, what doesn't" American Association of Swine Veterinarians National Meeting. February 24, 2024.
117. American Association of Swine Veterinarians (AASV) Annual Meeting Pre-Conference Seminar (2023), Denver, CO.
    a. Matchan, S. Introduction and brief overview of the Pig Survivability project.
    b. Ross, J. Overview of sow pelvic organ prolapse research.
    c. Dekkers, J. Is there a genetic basis for pelvic organ prolapse?
    d. Canavate, S. Sow Robustness: Key areas to maximize sow retention
    e. Rademacher, C. Early identification of at risk sows reduces sow mortality
    f. Johnson, C. Managing non-infectious causes of sow mortality
    g. Tokach, M. Overview of nutritional, genetic, and management strategies to influence mortality after weaning.

h. Magalhaes, E. Post-weaning mortality – key findings through data analysis
i. DeRouchey, J. Overview of available resources and producer tools.

Popular Press Articles, Extension/Outreach Publications, Digital Interviews
Digital Interviews

Popular Press and animal industry reports

1. Impact of pre-farrowing feed management strategies. National Hog Farmer. May 14, 2020.
2. Weaning age and antibiotic use for pigs evaluated. National Hog Farmer. July 9, 2020.
3. Structural soundness, gilt selection impact on future sow longevity. National Hog Farmer, August 4, 2020.
4. Maintaining continuity of nutrient intake after weaning: preweaning strategies. National Hog Farmer, March 11, 2021.
5. Research review focuses on managing nutrient intake during weaning stages. National Hog Farmer, March 17, 2021.
6. Maintaining continuity of nutrient intake after weaning: postweaning strategies. National Hog Farmer, May 13, 2021.
7. Nutritional enrichment effect on behavior, performance during early weaning. National Hog Farmer. October 21, 2021.
8. K-State researchers uncover clues to improving pig survivability. K-State Research and Extension, November 4, 2021.
9. Evaluation of supplemental fat sources and pre-farrow essential fatty acid intake on lactating sow performance and essential fatty acid composition of colostrum, milk, and adipose tissue. Kansas State University Swine Day, November 18, 2021.
10. Effect of floor feeding creep feed on the growth performance and mortality of pigs after weaning. Kansas State University Swine Day, November 18, 2021.
11. Effects of providing a liquid sensory attractant to suckling pigs in lactation and after weaning on post-weaning pig performance. Kansas State University Swine Day, November 18, 2021.
12. Effects of providing enrichment cubes to suckling pigs in late lactation and after weaning on post-weaning pig performance. Kansas State University Swine Day, November 18, 2021.
13. Effects of providing a sensory attractant powder to suckling pigs in late lactation and after weaning on post-weaning pig performance. Kansas State University Swine Day, November 18, 2021.
14. Effects of mat feeding on the growth performance and mortality of pigs after weaning. Kansas State University Swine Day, November 18, 2021.
15. Pelvic organ prolapse: on-farm considerations. National Hog Farmer. February 2, 2022.
16. How do mat and gruel feeding impact pig survivability? Pork Business. February 8, 2022.
17. Does EFA in lactation dies impact sow, litter performance? National Hog Farmer. May 4, 2022.
18. Attracting neonatal piglets away from the sow. National Hog Farmer. May 6, 2022.
19. Can sow mortality be influenced by early identification, treatment? National Hog Farmer. May 10, 2022.
20. The perplexing issue of uterine prolapse: how genetics fit. Pork Business. June 22, 2022.

21. Evaluation of fat sources on swine lameness and growth. National Hog Farmer. July 5, 2022.
22. Early Identification of treatment of sows. National Hog Farmer. August 19, 2022.
23. Effects of nutritional enrichment on pig feeder aggression and performance during early weaning. Animal Industry Report, September 18, 2022.
24. Neonatal piglet interaction with environmental enrichment ropes. Accepted Animal Industry Report. 2022.
25. Use of biologically relevant enrichment to improve nursery-aged pig weaning transition. Accepted Animal Industry Report. 2022.
26. Key findings regarding post-weaning mortality. National Hog Farmer. February 7, 2023.
27. Structural conformation impacts on sow longevity. National Hog Farmer. April 4, 2023.
28. 5 Ways to Improve Sow Longevity. Pork Business. April 27, 2023.
29. Heritability of Pelvic Organ Prolapse in Sows is Higher Than Previously Thought. Farm Journals Pork. July 18, 2023
30. Colostrum: The Key to Piglet Livibility. Farm Journal's Pork. July/August 2023

Factsheets

1. Stewart, K. Importance of Colostrum on Survival of Newborn Piglets (Available in English and Spanish)
2. K-State Team. Importance of Weaning Age on Survival of Wean-to-Finish Pigs (Available in English and Spanish)
3. K-State Team. Importance of Providing Injectable Iron to Newborn Piglets (Available in English and Spanish)
4. Spinler, M. and Rademacher, C. Individual Pig Care and Early Detection of Sick Pigs (Available in English and Spanish)
5. Elefson, E., Hagen, C., Greiner, L. Sow Body Condition Score and Survivability (Available in English and Spanish)
6. Suarez-Trujillo, A. and Stewert, K. Importance of Body Temperature on Piglet's Success (Available in English and Spanish)
7. K-State Team. Impact of Essential Fatty Acids on Sow and Litter Performance (Available in English and Spanish)
8. K-State Team. Gruel Feeding Nursery Pigs (Available in English and Spanish)
9. Euken, R. and L. Schulz. Assessing Economic Opportunity of Improving Mortality Rate in Wean-to-Finish Swine Production *Ag Decision Maker B1-78*
10. Euken, R. and L. Schulz. Assessing Economic Opportunity of Improving Mortality Rate in Breed-to-Wean Swine Production Ag Decision Maker B1-79
11. Kiefer, Z., Studer, J., Ross, J. Pelvic Organ Prolapse: Perineal Score Evaluation. (Available in English and Spanish)
12. Chipman, C. and Ross, J. Sow Mortality Project Update: Sow Body Conditioning score.
13. Chipman, C. and Ross, J. Water Treatment and Pelvic Organ Prolapse
14. Chipman, C. and Ross, J. Sow Mortality Project Summary
15. Statler, A and Stewart, K. Cross-Fostering Practices Explained (Available in English and Spanish)
16. deNeui, G and Stewart, K. The Common Practice of Split Suckling (Available in English and Spanish)
17. Walthart, B. Biosecurity Principles (Available in English and Spanish)
18. Walthart, B. and Skoland K. Pig Movement Principles (Available in English and Spanish)

19. Walthart, B. Early Identification of Lameness in Growing Pigs (Available in English and Spanish)
20. Walthart, B. and Brown, J. Early Identification of At-Risk Sows in the Farrowing House (Available in English and Spanish)
21. Walthart, B. and Petersen, M. Early Identification of Sick Pigs in the Nursery (Available in English and Spanish)
22. Walthart, B. Early Detection of At-Risk Pigs in the Finisher: Four Circles Approach (Available in English and Spanish)
23. Walthart, B. Newborn Piglet Principles (Available in English and Spanish)
24. Ramirez, B. Ventilation Management (Available in English and Spanish)
25. Sundman, E., Johnson, A., Gabler, N., Karriker, L., Stalder, K., and Millman, S. Pig Environment Enrichment
26. Rademacher, C. A Practical Approach to Early Intervention to Reduce Sow Mortality: SOP

Videos

1. Review of post-weaning mortality in commercial swine production Part 1: Non-infectious factors.
2. Review of post-weaning mortality in commercial swine production Part 2: Infectious factors.
3. Feeding strategies prior to farrowing and the impact on litter performance.
4. Feeding strategies prior to farrowing and the impact on sow performance.
5. Whole herd drivers of wean-to-finish mortality.
6. Identifying biological factors associated with pelvic organ prolapse: vaginal microbiome.
7. Strategies for Selection and Identifying Replacement Gilts Reproductive Tract Development: Part 1.
8. Importance of providing injectable iron to newborn piglets.
9. Effects of induction on the farrowing process and piglet blood parameters at time of farrowing.
10. Pre-weaning strategies to maintain continuity of nutrient intake after weaning.
11. Post-weaning strategies to maintain continuity of nutrient intake after weaning.
12. Individual pig care.
13. Improving rate of survivability of weaned pigs.
14. A practical approach to early intervention to reduce sow mortality.
15. Impact of essential fatty acids in lactation diets on sow and litter performance.
16. The common practice of split suckling. (Available in English and Spanish)
17. Cross-fostering practices explained. (Available in English and Spanish)
18. The Importance of Swine Herd Biosecurity (Available in English and Spanish)
19. Early Detection of Lameness (Available in English and Spanish)
20. Pig Movement Principles (Available in English and Spanish)
21. Early Identification of At-Risk Pigs in the Nursery (Available in English and Spanish)
22. Early Identification of Sick Pigs in the Finisher: Four Circles Approach (Available in English and Spanish)
23. Early Identification of At-Risk Sows in the Farrowing House (Available in English and Spanish)
24. Newborn Piglet Principles (Available in English and Spanish)
25. Ventilation Principles (Available in English and Spanish)
26. Basic Biology of Colostrum in Pigs.

Interviews

1. Perineal scoring first clue to pelvic-organ prolapse in sow-mortality project. Jason Ross interviewed by Pig Health Today. https://pighealthtoday.com/perineal-scoring-first-clue-to-pelvic-organ-prolapse-in-sow-mortality-project/. April 26, 2019.
2. National Hog Farmer. Drivers of wean-to-finish mortality – Interview with Dr Edison Magalhaes. https://www.nationalhogfarmer.com/farm-operations/drivers-wean-finish-mortality. November 4, 2019.
3. Researchers tackle survivability issues head-on. Jason Ross interviewed by Pig Health Today. https://pighealthtoday.com/researchers-tackle-survivability-issues-head-on/. November 14, 2019.
4. Pig health today. Comprehensive Data-Driven Approach to Lower Wean-Finish Mortality with Dr. Edison de Souza Magalhaes. https://pighealthtoday.com/mobile/article/?id=7585. December 20, 2019.
5. AASV 2020: Understanding pelvic organ prolapse and sow longevity. Jason Ross interviewed by Sarah Mikesell. https://thepigsite.com/articles/aasv-understanding-pelvic-organ-prolapse-and-sow-longevity. March 24, 2020.

Podcasts

1. The PigX podcast was created where you can join extension specialist and swine industry experts as they engage in conversations aimed to help producers succeed in raising healthy pigs.
    1. Season 1. Ep. 1: PigX The Launch!
    2. Season 1. Ep. 2: Colostrum Intake and Management
    3. Season 1. Ep. 3: Getting Pigs Started in the Nursery
    4. Season 1. Ep. 4: What Does the PRRS Virus and Biosecurity Have in Common?
    5. Season 1. Ep. 5: Body Condition Scores
    6. Season 1. Ep. 6: The impact of weaning age
    7. Season 1. Ep. 7: The People Factor
    8. Season 1. Ep. 8: 10 Steps to Reduce Wean-to-Finish Mortality
    9. Season 1. Ep. 9: 10 Steps to Reduce Wean-to-Finish Mortality Pt. 2
    10. Season 1. Ep. 10: The Economics Behind the Swine Industry
    11. Season 1. Ep. 11: Overall Sow Longevity
    12. Season 1. Ep. 12: Setting Up for Success
    13. Season 2. Ep. 1: Mortality Economics
    14. Season 2. Ep. 2: The Importance of Ventilation
    15. Season 2. Ep. 3: Transport Losses
    16. Season 2. Ep. 4: PRRS
    17. Season 2. Ep. 5: Stocking Density & General Mortality
    18. Season 2. Ep. 6: Stocking Density & General Mortality Part 2
    19. Season 2. Ep. 7: Swine Survivability Conference Recap
    20. Season 2. Ep. 8: Conference Recaps from Dr. Noel Williams
    21. Season 2. Ep. 9: Survivability and the Sow
    22. Season 2. Ep. 10: All About the People
    23. Season 2. Ep. 11: Industry Changes, the Post-Wean Transition, and More
    24. Season 2. Ep. 12: Sustainability in Pork Production
    25. Season 3. Ep. 1: Sow Farm Management
    26. Season 3 Ep. 2: The Definition and Purpose of Staged Loading

27. Season 3 Ep. 3: Genetic Resilience in Swine
28. Season 3 Ep. 4: Individual Sow Care
29. Season 3 Ep. 5: Actinobacillus Pleuopneumoniae (APP) Outbreaks and Prevention
30. Season 3 Ep. 6: Biocontainment in Grow Finish Hogs
31. Season 3 Ep. 7: Engaging Frontline Employees
32. Season 3 Ep.8: Survivability & Stress Alleviation
33. Season 3 Ep.9: Research on Heat Stress
34. Season 3 Ep.10: Gender Effects on Heat Stress
35. Season 3, Ep.11: Ventilation Related to Heat Stress
36. Season 3, Ep.12: In Utero Heat Stress
37. Season 4, Ep. 1: PROSPER Grant
38. Season 4, Ep. 2: Gilt Eligibility and Sow Longevity
39. Season 4, Ep.3: Domestic and International Sustainability
40. Season 4, Ep.4: Gilt Nutrition
41. Season 4, Ep. 5: Biosecurity and Foreign Animal Disease Overview
42. Season 4, Ep 6: PRRS Management Program
43. Season 4, Ep 7: Water Biology vs. Water Quality
44. Season 4, Ep 8: Gilt Selection & Sow Longevity
45. Season 4, Ep 9: Porcine Sapovirus

One-page podcast summaries are generated for all PigX podcast episodes. Seasons 1, 2, 3 & 4 are complete and posted on the survivability webpage.

2. Faculty or students on the project have contributed to external podcasts that are also distributed through various venues.
    a. SwineIt podcast: Wean-to-finish mortality: infectious causes – Dr. Jordan Gebhardt (May 21, 2020).
    b. SwineIt podcast: Wean-to-finish mortality: non-infectious causes – Dr. Jordan Gebhardt (Mar 9, 2020).
    c. SwineIt podcast: Starting pigs off right and other methods of decreasing pig herd mortality – Dr. Chris Rademacher (June 14, 2022).
    d. SwineIt podcast: First two lameness studies – Spenser Becker (February 1, 2022).

Decision Tools

1. Euken, R. and L. Schulz. 2021. Pig Survivability Project: Wean-to-Finish Mortality Economic Modeling *Ag Decision Maker B1-78*
2. Euken, R. and L. Schulz. 2022. Pig Survivability Project: Breed-to-Wean Mortality Economic Modeling *Ag Decision Maker B1-79*

In-Kind Donations

PI	Project	What was provided	In-Kind value, $
Tokach	Nursery Mat Feeding 1	Facility use	$ 25,000.00
Tokach	Nursery Mat Feeding 2	Facility use	$ 25,000.00
Tokach	Nursery Mat Feeding 3	Facility use	$ 25,000.00
Tokach	Sensory attractant studies x 2	Facility use	$ 50,000.00
Tokach	Gruel feeding	Facility use	$ 30,000.00
Tokach	Creep feed x nursery performance	Facility use	$ 50,000.00
Woodworth/Tokach	Sire line maturity	Facility use	$ 50,000.00
Woodworth	Transition meal feeding	Facility use	$ 75,000.00
Woodworth	Essential Fatty Acids in Lactation	Facility use	$ 100,000.00
Rademacher	Antibiotic Route Study Pre	Facility use - Nursery	$ 30,000.00
Rademacher	Antibiotic Route Study 1	Facility use - Nursery	$ 30,000.00
Rademacher	Antibiotic Route Study 2	Facility use - Nursery	$ 30,000.00
Rademacher	Sow Treatment	Facility use - Sow Farm	$ 50,000.00
Rademacher	Sow Treatment	Facility use - Sow Farm	$ 50,000.00
Greiner	Fatty acids and lameness	Graduate student	$ 72,089.00
Stewart	Meloxicam to sows	Drugs and labor	$ 10,000.00
Stewart	Meloxicam to sows	Facility Use - sow farm	$ 100,000.00
Stewart	Induction on survival	Facility Use - sow farm	$ 50,000.00
Ross	Pelvic Organ Prolapse 1	Facility use - Two Sow Farms	$ 100,000.00
Ross	Pelvic Organ Prolapse 2	Facility use - Two Sow Farms	$ 100,000.00
Ross	Pelvic Organ Prolapse 3	Facility use - Sow Farm	$ 50,000.00
Ross/Dekkers	Pelvic Organ Prolapse 4	Sow records and genotyping data	$ 500,000.00
		Total	**$ 1,602,089.00**

Additional Funding

PI	Project	Project funding, $
Linhares	Integrating data streams for causal inference and forecasting application to foster precision swine health & production management	$ 1,000,000.00
Tokach	2 Literature reviews	$ 25,000.00
Tokach	Sensory attractant study x 1	$ 25,000.00
Woodworth/Tokach	Sire line maturity	$ 30,000.00
Gebhardt	Bone Mineralization diagnostic survey	$ 39,952.00
Gebhardt	Bone Mineralization nursery and finishing trials	$ 59,927.00
Project PI's	Livability Conference Sponsorships	$ 96,000.00
Rademacher	Antibiotic Route Study	$ 69,791.83
Stewart	Piglet Survival	$ 20,000.00
Stewart	Colostrum supplementation	$ 10,000.00
Ross	Agalactia	$ 142,000.00
	Total	**$ 1,517,670.83**