SAES-422

Accomplishments Report

Project/Activity Number: NC1209

Project/Activity Title: North American Interdisciplinary Chronic Wasting Disease Research Consortium (herein, Consortium)

Period Covered: July 2024-June 2025

Annual Meeting Date(s): July 17, 2025 (virtual)

Participants: Our current list of members (n=77):
Debbie McKenzie (past chair), Jason Bartz, Kurt VerCauteren, Hui Li, Mark Ruder, Mark Zabel, Qingzhong Kong, Pam Skinner, David Walter (chair), Wei Zhang, Scott Wells, Justin Greenlee, Eric Cassman, Gavin Cotterill, William J. Severud, Stuart Lichtenberg, Patrice Klein, Krysten Schuler, Rodrigo Morales, Jennifer Malmberg, Michelle Gibison (vice chair), William Janousek, Russ Mason, Shigetoshi Eda, Lindsay Parrie, Paulina Soto, Heather Inzalaco, Ronald Shikiya, Marie Gilbertson, Nicholas Haley, Tiffany Wolf, Daniel Walsh, Miranda Huang, Marc Schwabenlander, Don White, David Hewitt, Georgia Titcomb, Wendy Turner, Qi Yuan, Hermann Schatzl, Sabine Gilch, Allen Herbst, Daniel Storm, Dwayne Etter, Steve Demarais, Tom DeLiberto, Sonja Christensen, Noelle Thompson, Peter Larsen, Tracy Nichols, Michael Zhang, Shuping Zhang, David Schneider, Robert Piel, Christopher Jennelle, Daniel Grove, Evelyn Merrill, Julie Blanchong, Kim Pepin, Lisa Muller, Rachel Ruden (secretary), Scott Hull, Tyler Harms, Tabitha Graves, David MacFarland, Jennifer Ballard, Paul Burr, Mandy Kamps, Bryan Richards, Neelam Poudyal, Rich Stedman, Bruce Lauber, Tricia Hebdon, Binod Chapagain, David Fulton, Cory Anderson, Richard Berl

Brief summary of minutes of annual meeting: The Consortium held its annual meeting on July 17th, 2025, virtually due to the travel restrictions and uncertainty of member employment due to the changing Presidential administration. This was a closed virtual meeting for NIMSS members of the Consortium, in which 43 members attended. We welcomed Rachel Ruden as our new Secretary after nominations during the meeting and votes post-meeting approved her into her new role - Welcome Rachel!

Accomplishments: In the past year, the Consortium continued to build upon past accomplishments and move forward on new ones. Twenty-four additional papers/reports were published by multiple members collaborating within the consortium. Two new collaborative grants were funded and we admitted 8 new members.

We renewed Multistate Research Project NC1209, “North American interdisciplinary chronic wasting disease research consortium” for an additional 5 years to run through September 30, 2030 (https://nimss.org/projects/19202).

Based on input at the 2023 annual meeting, the five original objectives of the Consortium have been expanded to include objectives pertaining to i) zoonotic potential of CWD and ii) environmental CWD prion contamination. The original objectives were: i) to develop a national CWD tissue and reagents repository, ii) to identify and/or create large-scale research facilities for controlled CWD research, iii) to improve CWD diagnostics, iv) to evaluate management

strategies across state boundaries and v) to use social science to inform CWD management. The Consortium has made significant progress towards addressing these objectives.

Objective 1: Development of a national CWD tissue and reagents repository.
There was a virtual meeting with USGS Fort Collins Science Center (FORT) in December 2024 to further discuss the intent and framework of SAGOTR within infrastructure at FORT that also included collaborators at the USDA-APHIS-Wildlife Services in Fort Collins, CO at the National Wildlife Research Center (NWRC). Additional funding in FY25/26 was planned for FORT through USGS Ecosystem Mission Area to further develop the Strain and Genetics Online Tissue Repository (SAGOTR) if permitted upon final federal budget approval. Members interested in participating in these meetings and development of SAGOTR should contact W. David Walter – wdw12@psu.edu

The USDA-NWRC in Fort Collins, CO has established a physical facility for storing CWD tissues and materials as well as tissues from animals infected with various other diseases. Metadata will be associated with each sample to include strain type (if available) and animal Prnp profile. The repository will use FreezerWorks to maintain the data. Dedicated personnel, Kelly Nelson, has been hired to maintain the metadata and the tissue archive.

Objective 2: Identification and/or creation of large-scale research facilities for CWD research
Allen Herbst has become a lead of this objective (replacing Steve Demarais); he joins the standing lead, Dave Hewitt. The group has developed and is maintaining a list of sites where CWD research is being conducted by consortium members along with the capabilities and capacities of those sites. Eight sites are now being used by consortium members to test different hypotheses concerning CWD transmission. Funding support for controlled CWD transmission studies was obtained at the US Geological Survey and experiments are expected to commence in 2025. Additional capacity is also being established at USDA facilities.
This objective has led to collaborations/research that likely would not have happened without the consortium.

Objective 3: Improvement of CWD Diagnostics
Over the past year, this objective group met twice to focus on improving CWD diagnostics. The primary outcome of these meetings was the development of a plan for a second ring-trial using both VMRD and Priogen's commercially available reagents. This trial will follow a standardized protocol with well-characterized samples and is intended to further validate the use of RT-QuIC as a diagnostic tool.

RT-QuIC testing of blinded MRPLN samples has already been completed. These results are now being followed up with transgenic mouse bioassays designed to better establish specificity. The goal of these bioassays is to differentiate true false positives from cases where RT-QuIC may simply be detecting CWD earlier than immunohistochemistry. Because mouse bioassays require months to years to complete, this portion of the work is ongoing.

Collaboration among consortium members has been a major driver of progress. Many members have contributed shared substrates, training sessions, samples, and virtual discussions to support onboarding of RT-QuIC and PMCA assays in other laboratories. These efforts are also facilitating additional cross-laboratory validations, which are critical for building confidence in these diagnostic tools.

Looking ahead, the group will work on developing case definitions and standardizing terminology associated with CWD diagnostics, RT-QuIC, and PMCA. We will also establish criteria for determining which assays are most appropriate for specific sample types, along with procedures for testing and result verification. Another key deliverable will be guidelines for retaining select positive samples for follow-up testing when discrepant results are observed. In the longer term, the group aims to develop methods for rapid CWD strain typing, which will provide greater clarity on how strains are defined based on their biological and molecular properties.

Objective 4: Evaluation of management strategies across state boundaries

Over the past quarter, the Objective 4 subgroup has met every other week and moved from project scoping via structured decision-making (SDM) into implementation planning for our multistate adaptive management experiment. With input from 10 human dimensions experts and in partnership with eight Midwestern state agencies, our study plans to test whether behavioral interventions, targeting hunters, landowners, and processors, can increase deer harvest in leading-edge and new foci CWD areas. We are currently developing the implementation plan with particular effort being focused on the design of the human dimension aspects of the project. The subgroup and collaborators also finalized a manuscript (soon to be submitted) on the challenges and lessons learned from conducting a cross-jurisdictional SDM scoping process. Additionally, to support this next phase, Objective 4 secured continued USDA funding to move from planning into a pilot implementation. Our intent is for these continued efforts to position Objective 4 to move into on-the-ground intervention testing in the coming year while sustaining progress toward long-term project goals.

Objective 5: Using social sciences to inform CWD management

Members of the group have completed the report for funding from USDA's Wild Cervid Management and Research program titled: Pairing CWD outreach to the context: social, cultural, and ecological variability. This work is led by Cornell University with several consortium members serving on the project advisory group and assisting with aspects of the research. This work focused on how hunters play a crucial role in managing the effects of chronic wasting disease (CWD) on cervid populations. Their behavior—including compliance with CWD regulations and recommendations—can either slow or hasten the spread of the disease. Additionally, their support for or opposition to CWD management efforts can significantly impact the effectiveness of those efforts.

Accomplishments: We addressed our research objectives through three phases of data collection: 1) analysis of a sample of CWD-related documents on state wildlife agency (SWA) websites on what SWAs communicated (e.g., messages about behaviors, characteristics of messages) and how communication differed by context, 2) interviews with key informants in 14 states through a multi-day workshop with our research advisory team to discuss findings from document analysis and key informant interviews, and 3) a series of six focus groups, where we presented deer hunters with test messages about CWD and then facilitated discussion about their reactions to those messages. Analysis of focus group data allowed us to challenge conclusions from earlier phases of data collection and make recommendations about future research and messaging.

Key findings and conclusions: The SWAs are communicating with hunters about the same set of 8 core behaviors related to reducing the risks of CWD (i.e., behaviors related to carcass transport, CWD testing, safe consumption of deer meat, reporting sick deer, proper carcass disposal, baiting/feeding of deer, safe food handling, and use of scent lures). However, despite

the focus on the same set of core behaviors, we found that a variety of differences in communication about hunter behavior exist across SWAs. These include:

1. Substantive differences in the messaging about certain behaviors such as prohibitions on baiting/feeding
2. How complex behaviors are described varies such as specific guidelines provided by SWAs for how to transport and dispose of carcasses safely differ
3. Differences in the particular behaviors emphasized most heavily by each state, the level of urgency communicated about the behaviors, and the level of risk and uncertainty communicated about CWD and hunter behaviors.

Objective 6: Strain Characterization

Previous objective 1c: *To assess zoonotic potential of CWD* has been moved to new Objective 6: Strain Characterization. There has been some progress on CWD zoonosis studies since the last report. CWD strain studies: The Glenn Telling group reported that peripheral inoculation with CWD led to different strains compared with CNS inoculation in their knock-in transgenic mouse models.

Model studies: The Cathryn Haigh group at RML published a paper reporting failure of detecting prion replication in human brain organoids after extensive exposure to CWD prions, which is consistent with the presence of a strong cervid-to-human species barrier for the common CWD strain; but it by no means excludes the possibility of zoonotic CWD transmission because of the limitations of the brain organoid model and the very limited number of organoids tested. The Qingzhong Kong lab detected RT-QuIC positive lymphoid tissues from multiple apparent sCJD subjects with possible exposure to CWD, and efforts are underway to evaluate potential link of these cases to CWD.

Human exposure assessment: Allen Herbst is leading an effort to better assess the scale of human exposure to CWD, and his initial report at the 2025 consortium annual meeting suggests a high level of exposure (likely in hundreds of thousands people annually). Noting that even if the attack rate of CWD is likely very low, the high levels of human exposure and long history of CWD in many areas may still lead to zoonotic transmission in some individuals.

CJD Surveillance in the USA: The National Prion Disease Pathology Surveillance Center (NPDPSC) reported over 2 probable/definitive prion disease cases/million in 2024, the highest level recorded so far, but it is believed to be largely due to better surveillance efforts and adoption of the ultra-sensitive CSF RT-QuIC assay in routine diagnosis.

Objective 7: To enhance methods and approaches for measuring CWD in the environment

Previous objective 1b: *To enhance methods for approaches for measuring CWD in the environment* has been moved to new Objective 7: Environmental. This group is headed by Dr. Lichtenberg. Previous meeting of the subgroup have identified next steps needed for research in environmental prion deposition, transmission, detection, and remediation. Several individual members have published on this topic in the past year, but no multi-site manuscripts have been produced. Similarly, we have no knowledge of joint grants submitted in the same time period. In the coming year, we intend to revisit and revise the research priorities in this area and cultivate collaborative projects in environmental prion research. In addition, we intend to assist with the inventory of physical prion research sites, as environmental research is intimately tied to physical locations.

Publications that include multiple member collaborations:

Bartz, J.C.; Benavente, R.; **Caughey, B.W.; Christensen, S.; Herbst, A**.; Hoover, E.A.; Mathiason, C.K.; **McKenzie, D**.; **Morales, R.**; Schwabenlander, M.D; Walsh, and D.P. 2024. Chronic wasting disease: state of the science. Pathogens. 2024; 13(2), 138.

Benavente, R.; Brydon, F.; Bravo-Risi, F.; **Soto, P**.; Reed, J.H.; Lockwood, M.; **Telling, G.**; Barria, M.A. and **Morales, R**. 2025. Detection of chronic wasting disease (CWD) prions in raw, processed and cooked elk meat, Texas, USA. Emerging Infectious Diseases. 31(2):363–367.

Booth, J.G., Hanley, B.J., **Thompson, N.E.,** Crespo, C.G., **Christensen, S.A., Jennelle, C.S**., Caudell, J.N., Delisle, Z.J., Guinness, J., Hollingshead, N.A. and Them, C.E., 2025. Management Agencies Can Leverage Animal Social Structure for Wildlife Disease Surveillance. Journal of Wildlife Diseases.

Bryant DN, Larsen RJ, Bondo KJ, Norton AS, Lindbloom AJ, Griffin SL, **Larsen PA, Wolf TM, Lichtenberg SS**. 2025. Evaluation of RT-QuIC Diagnostic Performance for Chronic Wasting Disease Detection Using Elk (Cervus canadensis) Ear Punches. J Wildl Dis. 61(1):64-75. doi: 10.7589/JWD-D-24-00071. PMID: 39617639.

Burgener, K., **Lichtenberg, S. S., Walsh, D. P., Inzalaco, H. N.**, Lomax, A., & **Pedersen, J. A.** (2024). Prion Seeding Activity in Plant Tissues Detected by RT-QuIC. Pathogens (Basel, Switzerland), 13(6), 452. https://doi.org/10.3390/pathogens13060452

Courtney, S. E., J. C. Magee, M. Nichols, **D. R. Etter**, S. M. Gray, **S. Christensen**, D. Williams, and G. J. Roloff. 2025. White-tailed deer behaviors at three forage settings: implications for transmission of chronic wasting disease. Journal of Wildlife Management 89:e70036. https://doi.org/10.1002/jwmg.70036

Darish JR, Kaganer AW, Hanley BJ, **Schuler KL, Schwabenlander MD, Wolf TM**, Ahmed MS, Rowden GR, Larsen PA, Kobashigawa E, Tewari D, **Lichtenberg S, Pedersen JA**, **Zhang S**, Sreevatsan S. Inter-laboratory comparison of real-time quaking-induced conversion (RT-QuIC) for the detection of chronic wasting disease prions in white-tailed deer retropharyngeal lymph nodes. J Vet Diagn Invest. 2025 Jan;37(1):86-93. doi: 10.1177/10406387241285165. Epub 2024 Oct 14. PMID: 39397658; PMCID: PMC11559902.

Grunklee, M.K., **S.S. Lichtenberg**, N.A. Lurndahl, **M.D. Schwabenlander**, D.L. Karwan, E.A. Li, **J.C. Bartz**, Q. Yuan, **P.A. Larsen, T.M. Wolf**. (2025). Detection of chronic wasting disease prions in soil at an illegal white-tailed deer carcass disposal site. Prion, *19*(1), 8–19. https://doi.org/10.1080/19336896.2025.2514947

Gurney, S.M., **S.A. Christensen**, M.J. Nichols, C.M. Stewart, D.M. Williams, S.L. Mayhew, N.A. Gilbert, and **D.R. Etter**. 2025. Harvest restrictions fail to influence population abundance. Ecosphere 16(8): e70358. https://doi.org/10.1002/ecs2.70358

Ho, N.; McGinn, R.; **Soto, P**.; Spraker, T.R.; Fischer, J.; **VerCauteren, K.; Nichols, T.** and **Morales, R.** 2025. Distribution of chronic wasting disease (CWD) prions in tissues from experimentally exposed coyotes (*Canis latrans*). PLoS One. 20(7): e0327485.

Huang MHJ, Demarais S, Strickland BK, Houston A, Banda A, **VerCauteren KC.** Chronic wasting disease effects on a breeding season behavior in White-tailed Deer (Odocoileus

virginianus). J Mammal. 2024 May 23;105(5):1175-1181. doi: 10.1093/jmammal/gyae050. PMID: 39345854; PMCID: PMC11427538.

Huang, M. H. J., **S. Demarais, M.D. Schwabenlander**, B.K. Strickland, **K.C. VerCauteren**, W.T. McKinley, G.e Rowden, C.C. Valencia Tibbitts, S.C. Gresch, **S.S. Lichtenberg, T.M. Wolf, P.A. Larsen**. 2025. Chronic wasting disease prions on deer feeders and wildlife visitation to deer feeding areas. Journal of Wildlife Management.

Jack AR, Sansom WC, **Wolf TM**, Zhang L, Schultze ML, **Wells SJ**, Forester JD. 2025. Assessment of mammalian scavenger and wild white-tailed deer activity at white-tailed deer farms. Viruses, 17, 1024.

King, L.; **Christensen, S. A.**; Dunfee, M.C.; Finoff, D.; Gidlewski, T.; **Haley, N.; McKenzie, D.; Morales, R.**; Miller, M.W.; Pybus. M. and **Wolf, T**. National Academies of Sciences, Engineering, and Medicine. 2024. State of Knowledge Regarding Transmission, Spread, and Management of Chronic Wasting Disease in U.S. Captive and Free-Ranging Cervid Populations. Washington, DC: The National Academies Press. https://doi.org/10.17226/27449.

Milstein M, Gresch SC, **Schwabenlander MD, Li M, Bartz JC**, Bryant DN, P.R. Christenson, L.L. Lindsey, N. Lurndahl, S. Oh, G.R. Rowden, R.L. Shoemaker, **T.M.** Wolf, **P.A. Larsen**, and **S.S. Lichtenberg**. 2025. Detection and decontamination of chronic wasting disease prions during venison processing. Emerg Infect Dis. 2025 Apr. https://doi.org/10.3201/eid3104.241176

National Academies of Sciences, Engineering, and Medicine. 2024. State of Knowledge Regarding Transmission, Spread, and Management of Chronic Wasting Disease in U.S. Captive and Free-Ranging Cervid Populations. Washington, DC: The National Academies Press. https://doi.org/10.17226/27449. Consortium members: **Sonja Christensen, Tiffany Wolf, Nicholas Haley, Debbie McKenzie, Rodrigo Morales**

Piel RB III, Veneziano SE, Nicholson EM, **Walsh DP**, Lomax AD, **Nichols, TA**, Seabury, CM, Schneider, DA. (2024) Validation of a real-time quaking-induced conversion (RT-QuIC) assay protocol to detect chronic wasting disease using rectal mucosa of naturally infected, pre-clinical white-tailed deer (Odocoileus virginianus). PLOS ONE 19(6): e0303037. https://doi.org/10.1371/journal.pone.0303037

Schwabenlander, M.D., J.C. Bartz, M. Carstensen, A. Fameli, L. Glaser, R.J. Larsen, M. Li, L.L. Lindsey, J.D. Oliver, R. Shoemaker, G. Rowden, S. Stone, **W.D. Walter, T.M. Wolf, P.A. Larsen**. 2024. Prion forensics: a multidisciplinary approach to investigate CWD at an illegal deer carcass disposal site. Prion, 18(1):72-86; DOI: 10.1080/19336896.2024.2343298

Simmons SM, Payne VL, Hrdlicka JG, Taylor J, **Larsen PA, Wolf TM, Schwabenlander MD, Yuan Q, Bartz JC. 2024**. Rapid and sensitive determination of residual prion infectivity from prion-decontaminated surfaces. mSphere 9:e00504-24. https://doi.org/10.1128/msphere.00504-24

Soto, P.; Bravo-Risi, F.; Kramm, C.; Gamez, N.; Benavente, R.; Bonilla, D.L.; Reed, J.H.; Lockwood, M.; Spraker, T.R.; **Nichols, T.** and **Morales, R**. 2024. Nasal bots carry relevant titers of CWD prions in naturally infected white-tailed deer. EMBO Reports. 25:334-350.

Soto, P.; Bravo-Risi, F.; Benavente, R.; Stimming, T. H.; Bodenchuk, M. J.; Whitley, P.; Turnage, C.; Spraker, T. R.; **Greenlee, J.; Telling, G.; Malmberg, J.**; Gidlewski, T.; **Nichols, T.**; Brown, V. R. and **Morales, R**. 2025. Presence of prions in wild pigs in areas with reported chronic wasting disease. Emerging Infectious Diseases. 31(1):168-173.

The CWD Working Group members (numerous consortium individuals as authors). Center for Infectious Disease Research and Policy (CIDRAP), University of Minnesota. "Chronic Wasting Disease Spillover Preparedness and Response: Charting an Uncertain Future". 2025. Available at: cidrap.umn.edu/chronic-wasting-disease/chronic-wasting-disease-spillover-preparedness-and-response-charting

Walter, W.D., A. Fameli, K. Russo-Petrick, J.E. Edson, C.S. Rosenberry, **K.L. Schuler,** M.J. Tonkovich. 2024. Large-scale assessment of genetic structure to assess risk of populations of a large herbivore to chronic wasting disease. Ecology and Evolution 14, e11347 10.1002/ece3.11347.

Walter, W.D., A. Herbst, C. Lue, **J.C. Bartz**, and M.C. Hopkins. 2025. Overview of North American isolates of chronic wasting disease used for strain research. Pathogens, Special Issue: Advances in Chronic Wasting Disease 14:250; https://doi.org/10.3390/pathogens14030250

Grants or funding received by multiple members to achieve one of our consortium objectives

Muller, L. M. Wilber, D. Grove. 2024. Stress effects on white-tailed deer in a high prevalence chronic wasting disease area. Wild Cervid Chronic Wasting Disease Management and Research Activities 2024. $203,326. September 2024–August 2025

We successfully extracted and assayed cortisol from 7 deer hair samples from CWD+ (mean = 1.30 pg/mg hair) and 10 where CWD was not detected (mean = 0.79 pg/mg hair; Table 2). Hair cortisol represents the hormone secretion during the growth of the hair and was significantly different by CWD status (P = 0.03). One of the deer was captured by helicopter net gun, collared on 1/28/2024, and died 12/6/2024 (313 days from capture). The cause of death was end-stage CWD. This deer had the highest hair cortisol measured (2.5 pg/mg hair) but low serum cortisol at initial capture (2.1 ug/dl). Metabolism changes may be occurring with CWD+ deer and indicated by cortisol concentrations.

Siemer, W. F., T. **B. Lauber**, R. C. Stedman, **K. Schuler,** and **S. Christensen**. 2025. Pairing CWD outreach to the context: social, cultural, and ecological variability. Center for Conservation Social Sciences Publ. Series 25-5. Cornell University, Ithaca, NY. Wild Cervid Chronic Wasting Disease Management and Research Activities 2024. $160,443. September 2024–August 2025.

Communication is a key tool used by agencies to promote risk-reducing behaviors among hunters and to build their support for management actions. The success of these communication efforts depends in part on how well agency messages align with the management context and how consistent those messages are with information from other sources. The goal of the project was to help state wildlife agencies improve the

consistency and coordination of their CWD messaging while tailoring communication strategies to their specific management contexts.

Walter, W.D., A. Fameli, C.S. Rosenberry, **K.L. Schuler**. 2024. Genetic assignment tests using single nucleotide polymorphisms in white-tailed deer as a management tool for chronic wasting disease. Wild Cervid Chronic Wasting Disease Management and Research Activities 2024. $179,513. September 2024–August 2025.

We successfully genotyped 745 samples from white-tailed deer using a medium-density array of single-nucleotide polymorphisms (SNPs) using previous funding across New York, Ohio, and Pennsylvania. Using this funding, we were able to add samples statewide from Delaware, Maryland, New Jersey and more localized in Staten Island, NY, and Washington, D.C. Initial efforts with previous funding have identified 82% of deer were assigned to their location of collection with the remaining requiring verification to origin based on our genetic assignment testing.

Other noteworthy accomplishments, documents, funding, etc. to achieve objectives

cwdbiosecurity.umn.edu. This CWD Biosecurity website is focused on biosecurity for cervid farms, and includes our downloadable CWD Biosecurity Assessment.

https://www.pa.gov/agencies/pda/animals/diseases/chronic-wasting-disease. This is the Pennsylvania Dept of Agriculture website, which has started to share short animated CWD Biosecurity videos that we created in collaboration with the PA Dept of Agriculture. These videos were modeled after the Mississippi State University CWD short animated videos focused on CWD in wild deer. These new videos are focused on CWD prevention for cervid farmers. Two videos are posted to date, with several more coming soon.

Chronic Wasting Disease Summit - Meeting to present and discuss new information on CWD research and management. The Summit was hosted by the University of Pennsylvania's Wildlife Futures Program in Wilmington Delaware, 2-3 June 2025. The Summit was attended by Consortium members **Michelle Gibision, Dave Hewitt, Stuart Lichtenberg, Neelam Poudyal, W. David Walter**