2022

Public Health Implications of Chronic Wasting Disease: A Fifteen Year Follow-Up to a Point Source Exposure in Upstate New York

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Public Health Implications of Chronic Wasting Disease: A Fifteen Year Follow-Up to a Point Source Exposure in Upstate New York

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Introduction

- Prion diseases in humans and other animals are caused by misfolded proteins which produce rare and uniformly fatal neurodegenerative disorders (NIH, 2022).
- Prion diseases represent a significant public health concern due to their ability to occasionally cross the species barrier and infect humans as exemplified by the recent outbreak of variant Creutzfeldt-Jakob disease in humans through the consumption of prion contaminated beef (Mad Cow Disease) in the United Kingdom during the 1980s and 1990s.
- Kuru, the first human prion disease reported among the Fore people of then Australia New Guinea during the late 1950s was unknowingly spread through ritual cannibalism and began to decline and eventually disappeared when cannibalism ceased and mortuary practices changed during the 1960s. (Alpers, 2007).
- Another Prion disease, Chronic Wasting Disease (CWD) in cervids (deer, elk moose, caribou) was first detected in mule deer in Colorado and Wyoming in 1967 (Olszowy et al., 2015).
- CWD is transmitted between deer and other cervids through contact with saliva, blood, and contaminated soil. (Kuznetsova et al., 2014). Therefore, consumption of contaminated venison may pose a serious risk to humans if CWD follows a route of transmission similar to that of variant Creutzfeldt - Jakob disease as prion diseases are 100% fatal and it is unclear whether CWD can cross the species barrier to humans.
- As of March 2022, CWD has been detected in cervids from North America (**Figure 2**), Norway, and South Korea (USGS, 2022).

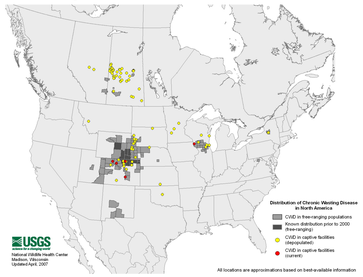

Figure 1 Distribution of Chronic Wasting Disease in North America, updated April 2007 (USGS 2007).

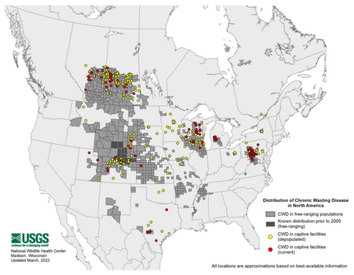

Figure 2 Distribution of Chronic Wasting Disease in North America, updated March 6, 2022 (USGS 2022).

Methods

- In 2005, attendees at a Sportsman's Feast in Oneida County, NY were exposed to venison which tested positive for CWD. This event represents the only known large-scale point source exposure of humans to CWD.
- Due to the long incubation period of prion diseases in humans, which can last years or even decades before the onset of symptoms, this study followed a cohort of 71 participants who attended the Sportsman's Feast to evaluate any changes in their health status and behavioral risks which may increase their chance of further exposure to animals potentially infected with CWD in the wild in upstate New York.
- Follow-up surveys were administered to study participants for each hunting season between 2005 and 2020.
- Data from each annual survey were entered into their corresponding Microsoft Excel spreadsheet using double entry, cross-check, and proof-reading to ensure accuracy.
- Data from the non-longitudinal 2006 sample (42 participants) and longitudinal 2020 sample (29 participants) were analyzed through the calculation of frequency data (percentages) for risk behaviors and health outcomes.
- Data from 2020 are based on a longitudinal sample of 29 of the original participants from 2006, as the remainder of the cohort (n=42) were lost to follow-up.
- Binghamton University is currently awaiting an evaluation of death certificates by the Oneida County Health Department to verify that those who were lost to follow-up have not died from Creutzfeldt-Jakob Disease or a variant of it.

Results

- The 2006 non-longitudinal cohort (n=42) demonstrated a higher frequency of risk behaviors such as hunting, field dressing, removing antlers, and consuming venison compared to the longitudinal 2006 cohort (n=29) **(Figure 3).**
- The 2006 non-longitudinal cohort (n=42) demonstrated a significantly lower frequency of glove wearing when compared to the longitudinal cohort (n=29).
- The frequency of self-reported neurological symptoms was higher among the 2020 longitudinal cohort (n=29) than the 2006 non-longitudinal cohort (n=42). However, there were no instances of self-reported, or physician diagnosed neurological diseases, including Parkinson's, Multiple Sclerosis, Alzheimer's, or Creutzfeldt- Jakob's Disease in the 2020 longitudinal cohort (n=29) **(Figure 4).**
- Our results indicate a decreased frequency of risk behaviors including hunting, removing antlers, and consuming venison, for the 2020 longitudinal cohort of participants (29) compared to the same participants in 2006 **(Figure 5).**
- For the 2020 longitudinal cohort, there was a decreased frequency of self-reported neurological disease compared to the same participants in 2006. No instances of physician diagnosed neurological disease were reported **(Figure 6)**.

Comparison of Risk Behaviors and Health Outcomes of the 2006 Samples

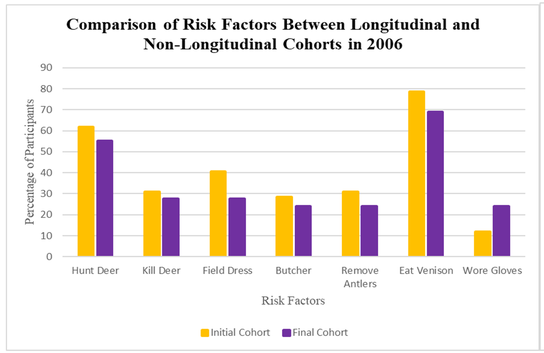

Figure 3: Comparison of risk factors between non-longitudinal (n=42) and longitudinal (n= 29) cohort in 2006.

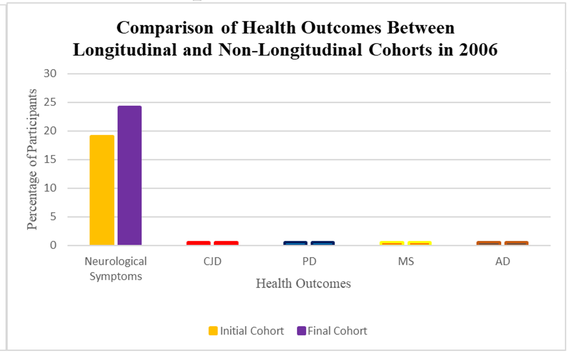

Figure 4: Comparison of health outcomes between the non-longitudinal (n=42) and longitudinal cohort (n=49) in 2006.

Longitudinal Comparison of Risk Behaviors and Health Outcomes in 2006 and 2020

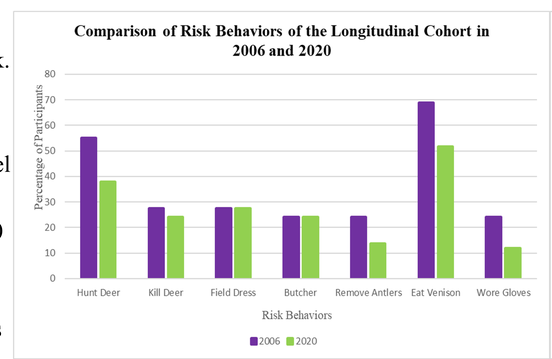

Figure 5: Comparison of risk behaviors of the longitudinal cohort (n=29) between 2006 and 2020.

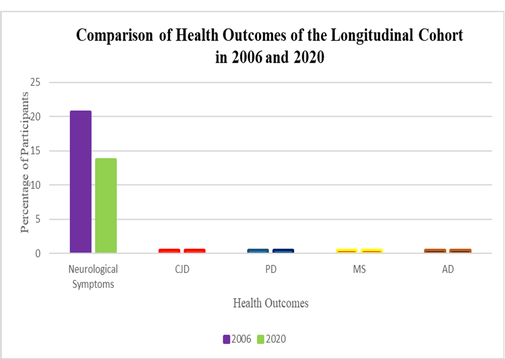

Figure 6: Comparison of health outcomes of the longitudinal cohort (n=29) in 2006 and 2020.

Discussion and Conclusions

- A 15-year longitudinal follow-up of the same 29 participants from 2006 and 2020 found no definitive health outcomes that indicate transmission of a neurological disease to humans.
- When considering these trends, it is important to note that changes in hunting behaviors may be at least partially attributed to advancing participant age due to the duration of this longitudinal study.
- Furthermore, the self-reported nature of these health outcomes may partially explain the higher frequency of reported neurological symptoms immediately following the point source exposure in 2005 when compared to the final survey in 2020, as the individuals participating in this study knew that they had been exposed to CWD.
- There were no physician diagnosed instances of CJD, Parkinson's, Multiple Sclerosis, or Alzheimer's Disease among the final 2020 cohort (n=29), or as far as we are aware, among any of the original participants from 2006 who attended the game dinner and who were lost to follow-up (n=42).
- Binghamton University is working with the Oneida County Health Department to examine death records and verify that those individuals who were lost to follow-up did not die from CJD, or any other prion-like disease.

References

National Wildlife Health Center. Expanding Distribution of Chronic Wasting Disease. U.S. Geological Survey 2022 https://www.usgs.gov/centers/nwhc/science/expanding-distribution-chronic-wasting-disease (Accessed March 31 2022)

National Institute of Allergy and Infectious Disease. Prion Diseases. National Institute of Allergy and Infectious Disease 2022. https://www.niaid.nih.gov/diseases-conditions/prion-diseases#:~:text=Prion%20diseases%20include%20bovine%20spongiform,%2C%20elk%2C%20moose%20and%20reindeer (Accessed April 2 2022)

Garruto, RM, et al. Risk behaviors in a rural community with a known point-source exposure to chronic wasting disease. Environmental Health 2008; 7:31.

Kuznetsova, A., et al. Potential role of soil properties in the spread of CWD in Western Canada. Prion. 2014; 8:1.

Olszowy, KM, et al. Six-year follow-up of a point-source exposure to CWD contaminated venison in an Upstate New York community: risk behaviours and health outcomes 2005-2011. Public Health. 2014; 128:9.

Alpers, MA. A history of kuru. PNG Med J. 2007; 50:(1-2).

Haley, NJ, & Hoover, EA. Chronic Wasting Disease of Cervids: Current Knowledge and Future Perspectives. Annual Review Animal Bioscience. 2015; 3:1.

Zink, RM. Genetic and evolutionary considerations of the Chronic Wasting Disease – Human species barrier. Infection, Genetics and Evolution. 2020; 84.

Waddell, L, et al. Current evidence on the transmissibility of chronic wasting disease prions to humans—A systematic review. Transboundary and emerging diseases. 2018; 65:1.

Maheshwari, A, et al. Recent US case of variant Creutzfeldt-Jakob disease-global implications. Emerging infectious diseases. 2015; 21:5.