Respiratory virome of backyard poultry and education of owners about respiratory pathogens

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Background

- Small Poultry Flocks - the trend of raising small (<500 birds) flocks of poultry (chickens, chicks, ducks, ducklings, geese, and turkeys) is growing
- Small flock owners (SFOs including backyard flock owners) - lack knowledge of poultry diseases and biosecurity practices
- Viruses are the leading cause of respiratory tract infections in humans, animals, and poultry
- Emerging and re-emerging diseases in poultry, specifically velogenic Newcastle disease (vND), avian influenza and other respiratory viruses, present a major threat to avian species worldwide
- The SFOs need to know about common pathogens that may affect their birds and how to control them

Objectives

- Prepare and disseminate educational materials regarding respiratory pathogens of poultry to SFOs and veterinarians at the local and regional levels

- In backyard/small flock chickens, use NextGen sequencing to characterize respiratory viruses, which might also affect commercial poultry and may have zoonotic potential

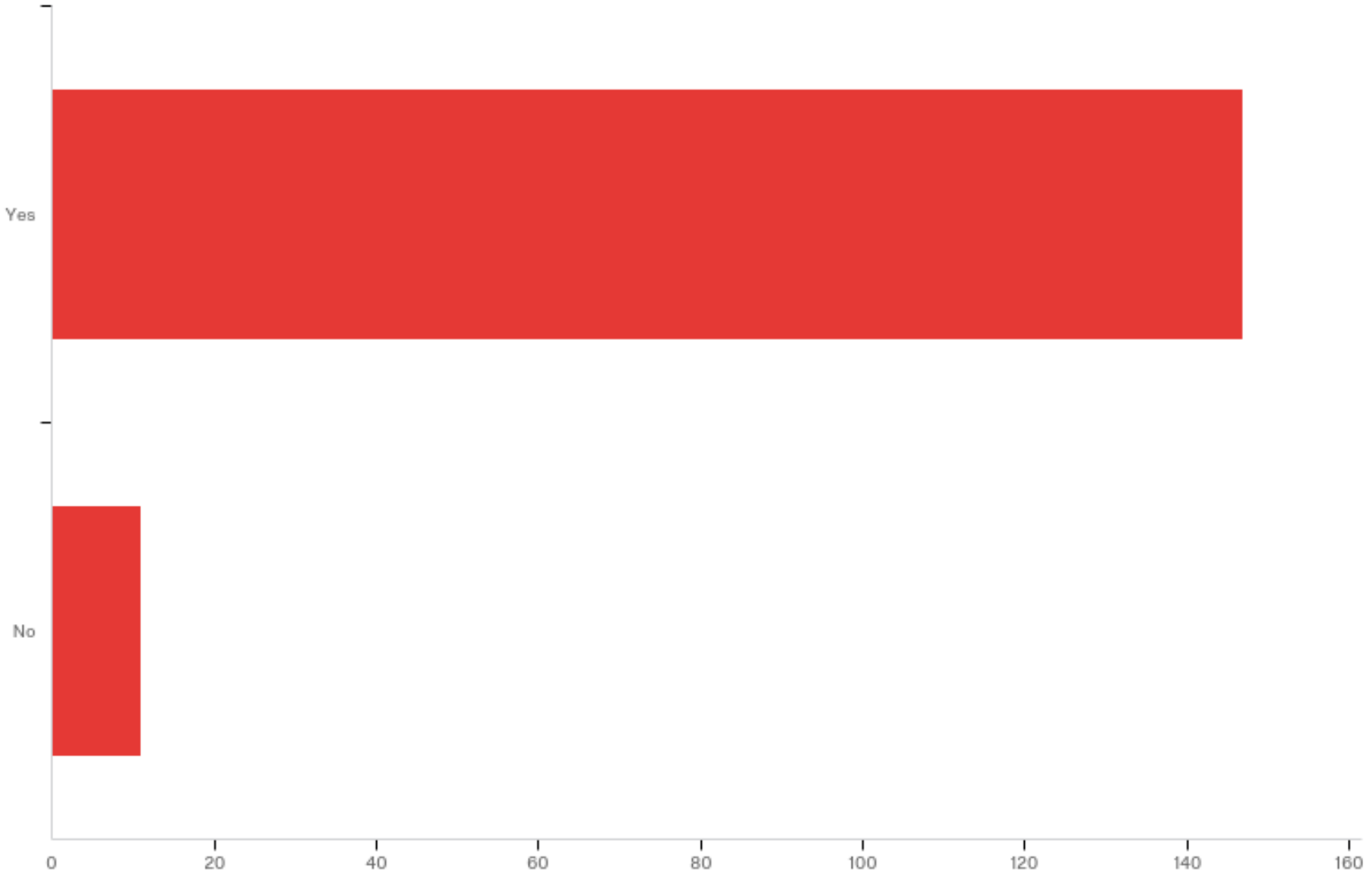
Objective 1- Survey

- A survey was conducted with an objective of understanding the background of SFOs
- Qualtrics- an online survey format
- Twenty-question survey was sent to
  - Two well-visited Facebook groups
  - To SFOs whose flocks were tested during the 2015 HPAI outbreak

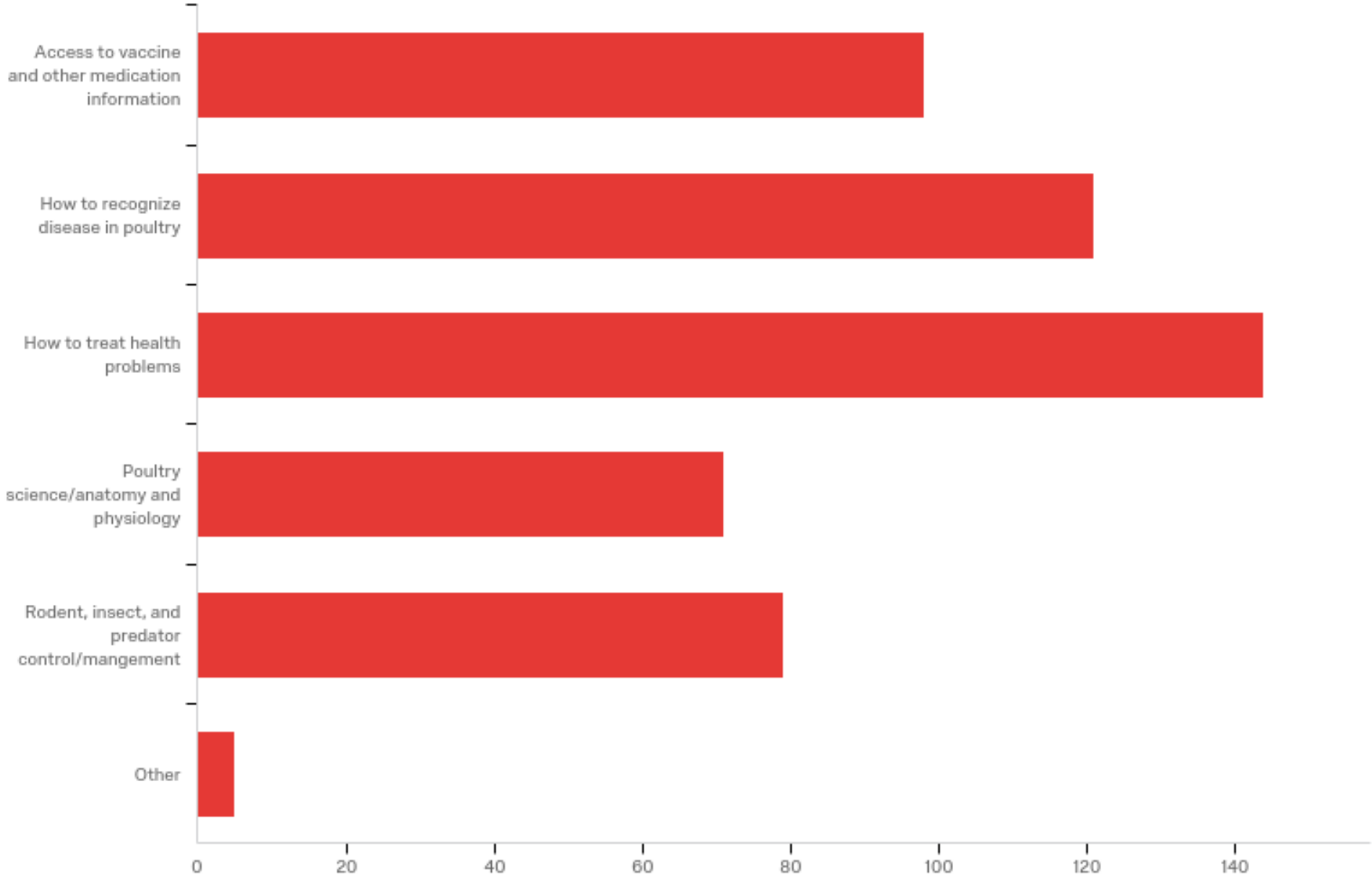
Objective 1- Survey results

- 41% were <35 years old (n=166)
- 72% have had poultry for <5 years (n=166)
- Average flock size is <10 birds (n=164)
- 40% raised poultry for food and fun/hobby (n=368)
- 77% are aware of poultry vaccines (n=159)
- 71% have never vaccinated their birds (n=122)
- Many SFOs have raised birds for less than five years and expressed a lack of knowledge of poultry diseases

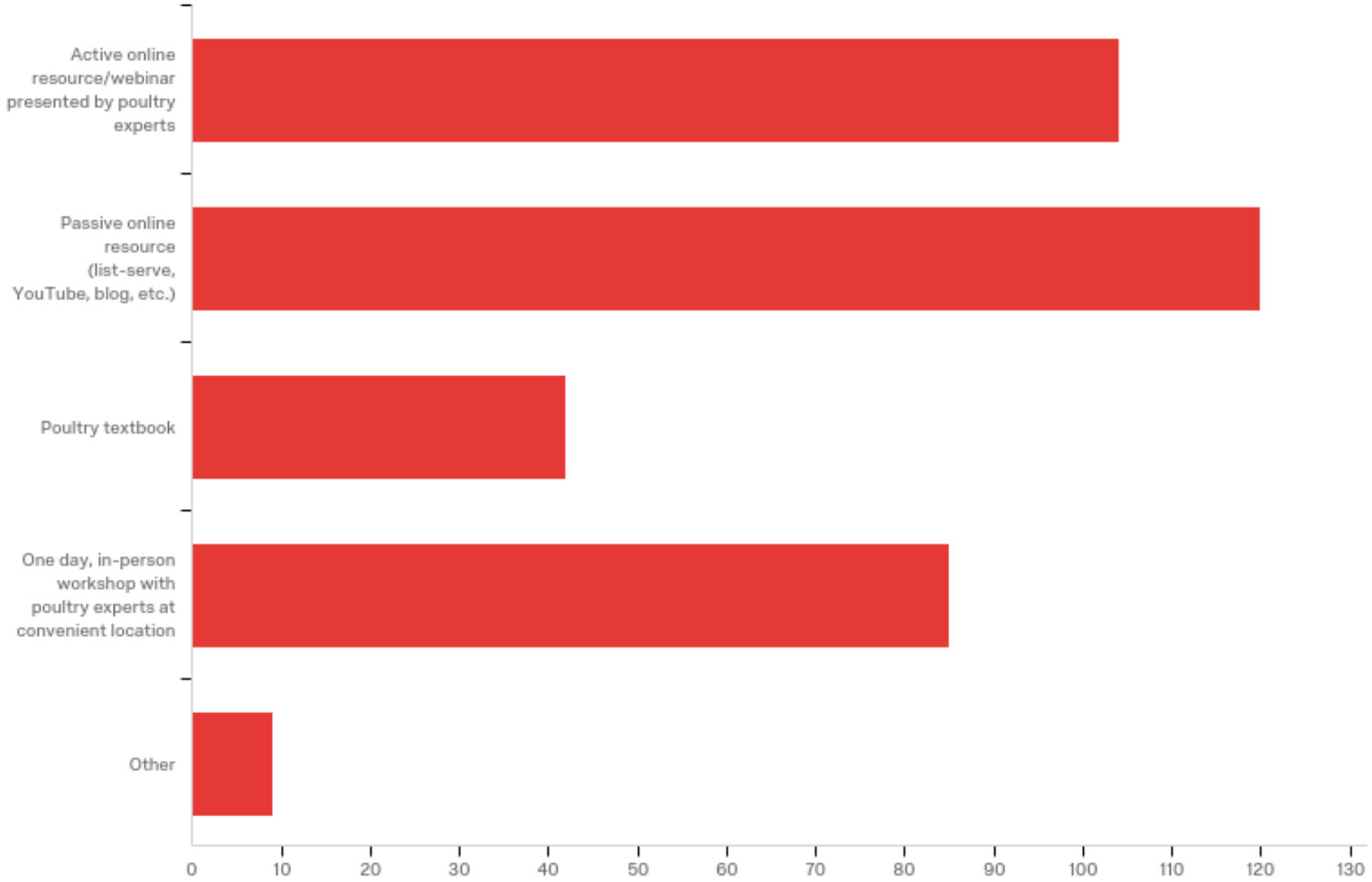
Would you be interested in additional educational information and programs to learn about poultry health?



What information regarding poultry health would you like to learn more about? Please select all that apply.



How would you prefer to receive information about poultry health? Please select any forms you would consider using.



Objective 1- Extension and educational activities

- A subcommittee was formed to prepare educational content of workshops for backyard owners and veterinarians
- First year emphasis was on small flock owners
- A total of five workshops have been offered

Objective 1- Workshops

- February 17, 2018- Douglas County- Alexandria -attendance 25
- March 3, 2018- Elko New Market - attendance 17
- March 10, 2018- St. Cloud - attendance 16
- April 7, 2018-Rushford - attendance 11
- April 14, 2018- St Peter - attendance 18

Objective 1- workshops

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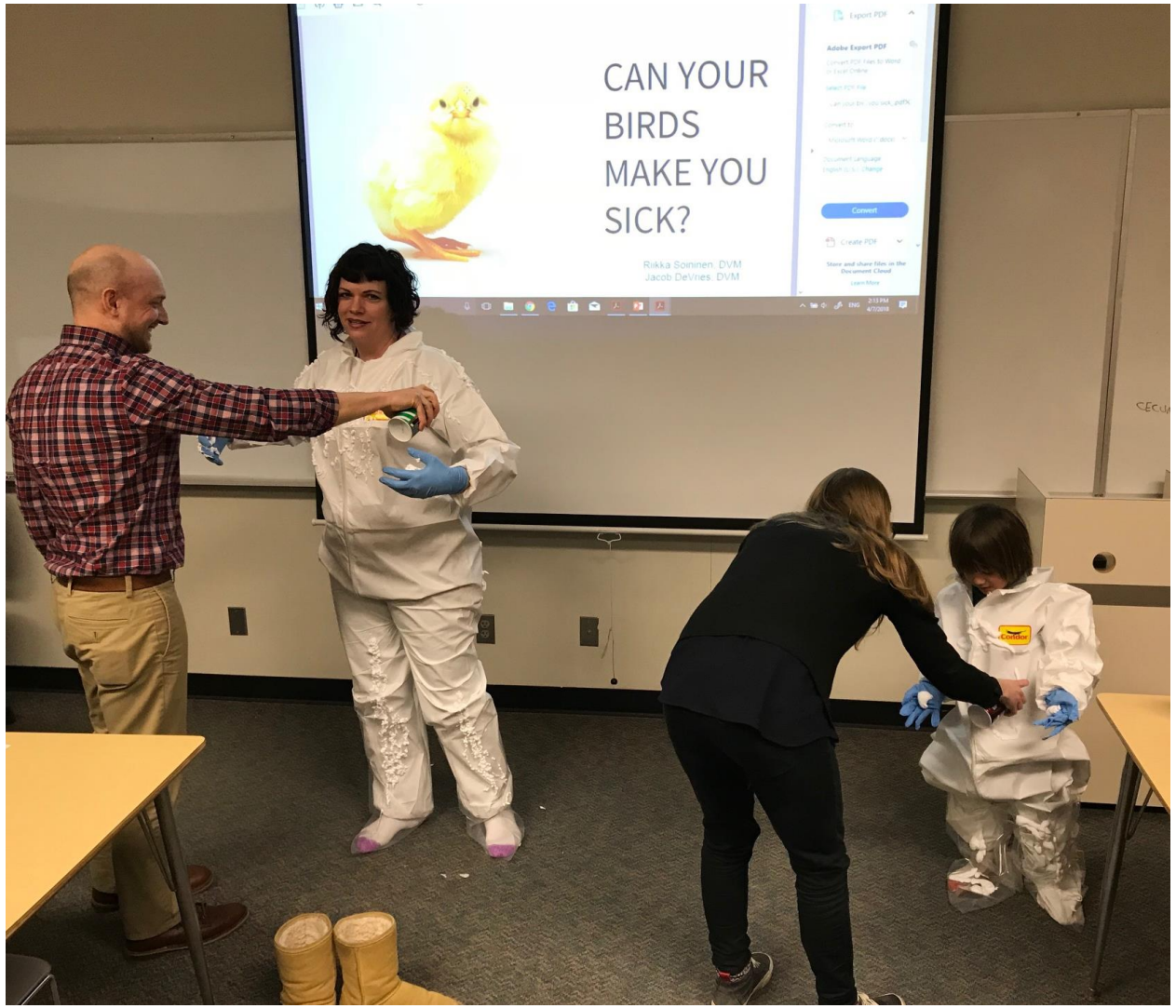


Objective 1- Educational materials

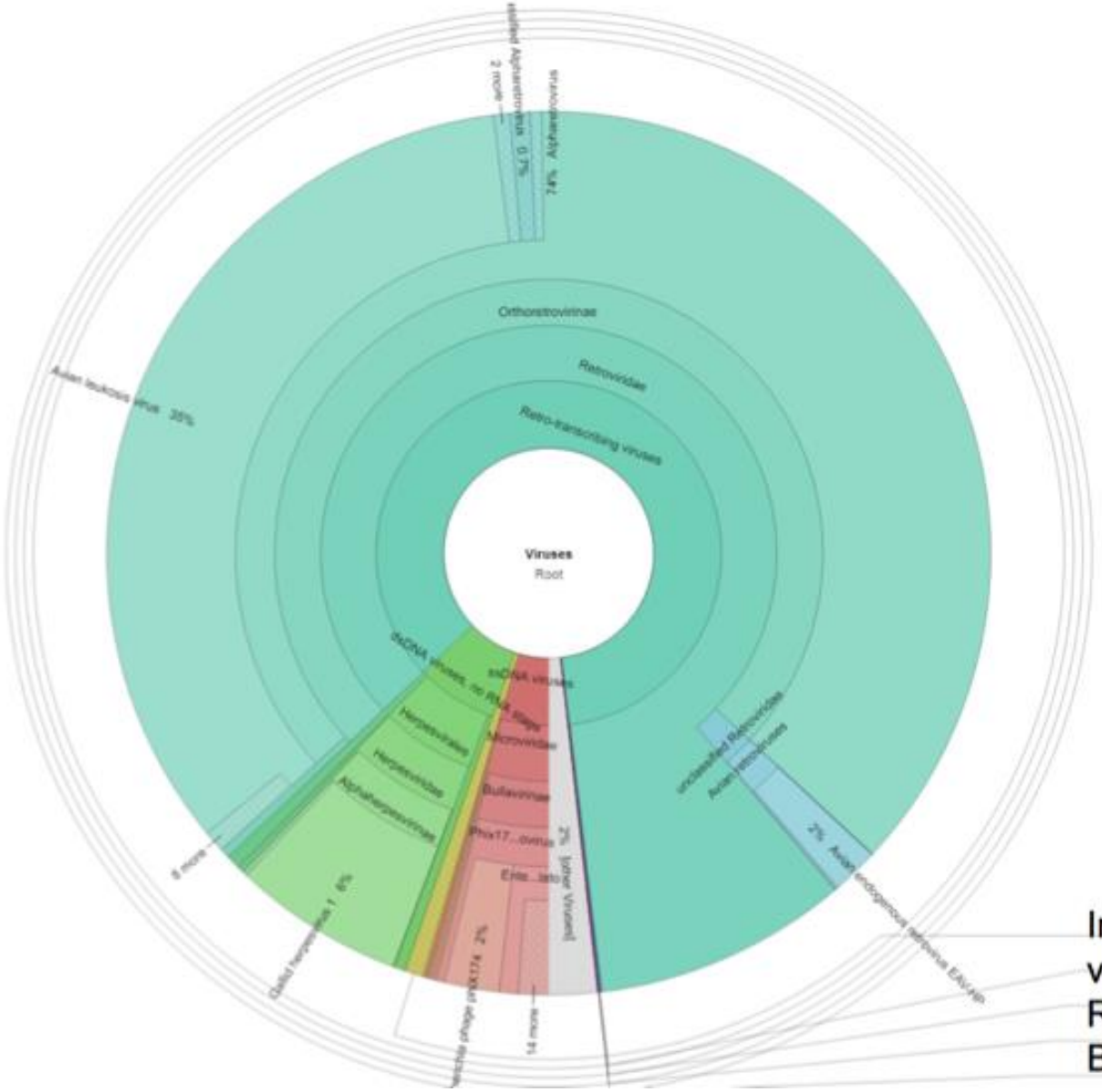
- Dr. Porter has prepared two separate training handouts on:
  - Necropsy of the laying hen
  - Necropsy of the turkey
- These will be used as educational material for veterinary workshops
- Videos of the Spring 2018 small flock workshops were recorded
- They are now being edited for use as education material on the University of Minnesota Extension website

Objective 1-sampling

Virome analysis

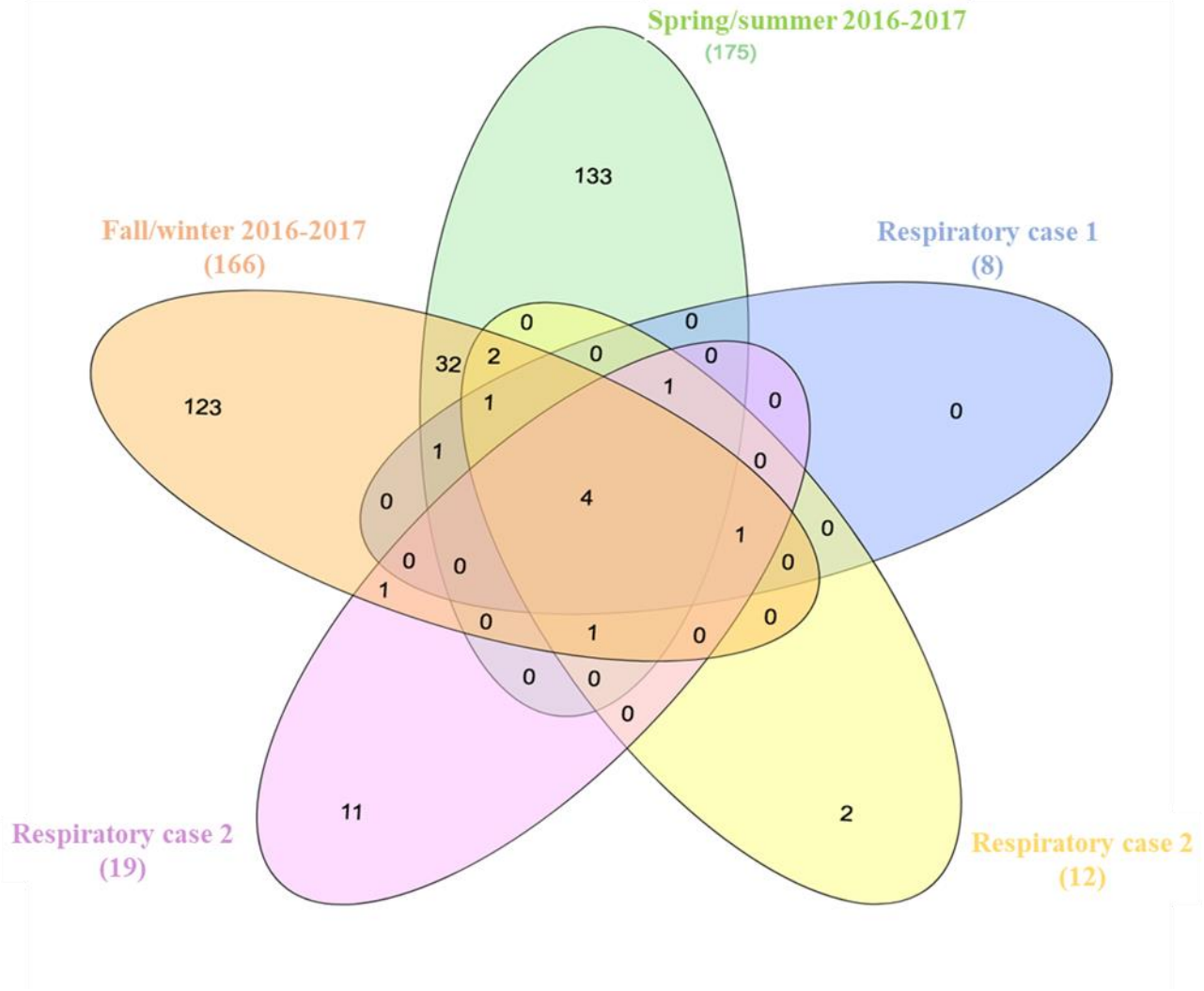
- Collected tracheal swabs from backyard flocks located in nine different counties in Minnesota from Oct 2016 to April 2017
- 17 NGS pooled were prepared from total 64 samples
- 15 samples collected in spring and summer 2018
- 3/15 from flocks showing respiratory signs
- RNA extraction- purified RNA was checked for quality and quantity
- cDNA synthesis (RNA) and library preparation
- Illumina MiSeq for 300 paired end cycle sequencing
- Illumina reads analysis using custom NGS pipeline

Krona showing Kraken classification



NGS results

- Gallid herpesvirus-1 was detected in all respiratory cases
- Chicken picornaviruses
- Gemycircularvirus
- Avian leukosis virus
- Endogenous retroviruses
- Bacteriophages



Venn diagram showing number of viruses specific to a particular sample in comparison to all other samples or common between samples

Proposed work for Year 2

Objective 1- Proposed workshops

- Follow-up small flock workshops for each of five regions are planned for Winter and Spring of 2019
- The second workshop in each region will focus on
  - Recognition, prevention and treatment of common diseases of poultry
  - Basics of the respiratory and digestive systems of poultry
  - Summary of NexGen sequencing results on tracheal swabs collected from small poultry flocks
- To record and edit for presentation on the University of Minnesota extension website in late Spring 2019

Objective 1-Proposed workshop for veterinarians

- An intensive, hands-on workshop that includes the following:
  - Basic poultry breeds
  - Key diseases (with prevention and treatment) of small poultry flocks
  - Basics of anatomy and physiology
  - Methods of poultry vaccination
  - Afternoon wet lab on blood collection and necropsy of chickens and turkeys
- We intend to conduct the workshop in Jan-Mar 2019
- Aggressive advertising to attain a minimum registration of twenty veterinarians

Virome analysis

- Samples collected in summer 2018
- Additional samples will be collected in fall 2018 and winter 2019
- RNA extraction- Purified RNA checked for quality and quantity
- cDNA synthesis using random hexamers
- Library prep - NexteraXT (Illumina Inc.) kit
- Illumina MiSeq for 300 paired end cycle sequencing
- Illumina reads analysis –
  - custom NGS pipeline
  - commercially available software

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Thank you