CEZD Annual Performance Report

April 2019 - March 2020

Executive Summary

This annual performance report covers the period from 1 April 2019 – 31 March 2020 and provides statistics on: KIWI signal filtration, information source signal production, signal relevancy, community development, and disease trends. The report is provided to all CEZD members in an effort to promote awareness on system performance, community engagement, notable disease events, and future direction.

The following highlights provide a quick overview of CEZD's growth and development over the last year, as well as any notable events that occurred.

Highlights:

- As of May 2020, the CEZD consists of 355 members (160 CNPHI account members and 195 consumers). An increase of 17% from the previous year.
- CEZD members are located in 9/10 provinces.
- 94% of respondents to the annual survey indicated that CEZD provided them value in their work.
- From 1 April 2019 to 31 March 2020, the KIWI technology filtered through 30,350 Individual Information Pieces. CEZD members rated 47,398 Anticipatory Intelligence Signals and produced a total of 558 Early Warning Signals, in 51 weekly intelligence reports.
- Avian Flu Diary, ProMed, Outbreak News Today, and Community Reported Events produced the largest amount of relevant signals this year.
- From April 2019 to March 2020 KIWI received Anticipatory Intelligence Signals from 168 different countries.
- The majority of Anticipatory Intelligence Signals occurred within the USA, followed by China and Canada.
- COVID-19 was the most frequently reported health condition, followed by influenza and African Swine Fever.
- The most notable events from 2019-20 include the COVID-19 pandemic, Porcine Epidemic Diarrhea in Manitoba, Eastern Equine Encephalitis in the US, Streptococcus zooepidemicus in North America, and African Horse Sickness in Thailand.
- The CEZD core team carried out six online engagement meetings with members from Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia, with additional meeting scheduled in the next few months of 2020
- Two domestic pilot simulation scenarios on the Asian Long Horned Tick were completed, the first with Ontario and second with Alberta.
- In the coming fiscal year, CEZD will continue with ongoing activities, move forward with the domestic pilot and the development of policies and procedures, explore options for executing rapid risk assessments, and expand our scope to include aquatic diseases.

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Definitions

Anticipatory Intelligence Signal (AIS)	A disease event that originates from the list of Individual Information Pieces and is to be rated by the community.
Automatic AIS	A disease event automatically selected by KIWI's sense making algorithm from the list of Individual Information Pieces.
Manual AIS	A disease event that was not identified automatically by KIWI's sense-making algorithm from the list of Individual Information Pieces but rather by analysts.
CEZD CNPHI-account member	A CEZD member who has signed up for CNPHI and has access to the KIWI technology and CEZD Collaboration Centre.
CEZD consumers	A CEZD member who has not signed up for CNPHI and only receives the CEZD Weekly Intelligence Reports.
Community Reported Event (CRE)	A disease event submitted into the KIWI technology from an outside information source by a member, to be rated by the community.
Early Warning Signal (EWS)	An anticipatory intelligence signal that achieves an average community rating equal to or greater than 2.8.
False-negative	An individual information piece that was not identified as an anticipatory intelligence signal by KIWI's sense making algorithm but is relevant to emerging and zoonotic disease.
False-positive	An anticipatory intelligence signal that achieves an average rating of 1 "not relevant".
Individual Information Piece (IIP)	A disease event that enters the KIWI technology via RSS feeds from a subscribed information source, which has yet to be filtered through the KIWI algorithm.
Information Source	An open website that provides disease event news.
Knowledge Integration using Web-based Intelligence (KIWI) Technology	The Knowledge Integration using Web-based Intelligence technology within CNPHI filters through the vast amount of open disease event information on the web by applying a sense making algorithm. KIWI enables users to monitor global disease events and evaluate their relevance to Canada.
Outreach Engagement Workgroup (OEW)	A working group of CEZD members dedicated to the recruitment of new members and engagement of existing members.
Reporting & Analysis Workgroup (RAW)	A working group of CEZD members dedicated to refining reporting procedures and identifying new opportunities for reporting and analysis.

Introduction

The Community for Emerging and Zoonotic Diseases (CEZD) is a virtual network that integrates automated information-mining tools with professional multidisciplinary perspectives. CEZD's disease intelligence process is designed to provide early identification and warning of threats. Timely and effective intelligence reports are provided back to the communities at risk to help enable them to prevent, avoid or reduce their risk and prepare for an effective response.

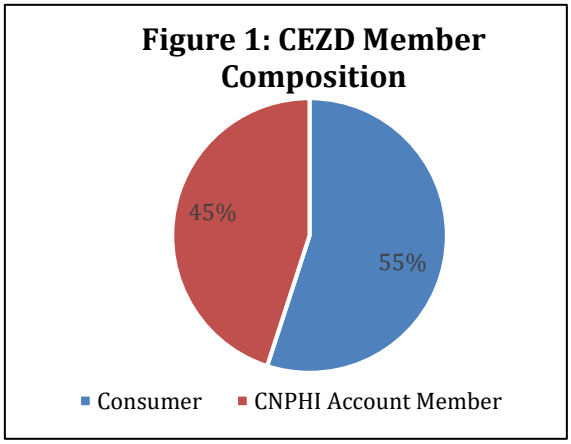
CEZD utilizes the Public Health Agency of Canada's (PHAC) Canadian Network for Public Health Intelligence (CNPHI) platform for its day-to-day operations. Within CNPHI, the community uses the Knowledge Integration Using Web-based Intelligence (KIWI) technology and the CEZD Collaboration Centre. The KIWI Emerging and Zoonotic program collects and filters disease signals from open information sources. Then the members analyze the information and the core team disseminates the results in the form of Weekly Intelligence Reports.

This annual report covers the period from April 1 2019 – March 31 2020, and provides information on current CEZD efforts as well as: demographics, stakeholder engagement efforts, KIWI technology, Anticipatory Intelligence Signal trends, and the CEZD Collaboration Centre. It concludes with CEZD's key priorities and action items going forward.

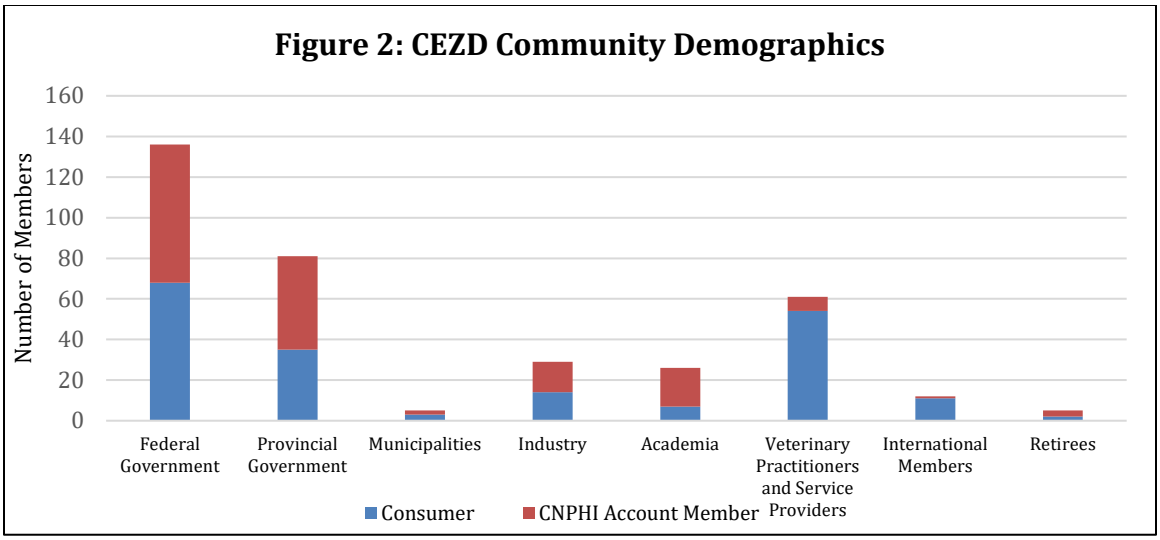
CEZD Demographics

As of May 2020, the CEZD consists of 355 members, 4 of which are in the core team. Over the last year, 60 new members have joined the CEZD community, an increase of 17% from the previous year. **Figure 1: CEZD Member Composition** displays the percentage of members who hold a CNPHI account and those who do not, the latter only receive the intelligence reports and are known as consumers. The membership growth over this year occurred mainly in the consumers group, making up a total of 55% of CEZD membership, with CNPHI account members occupying 45%.

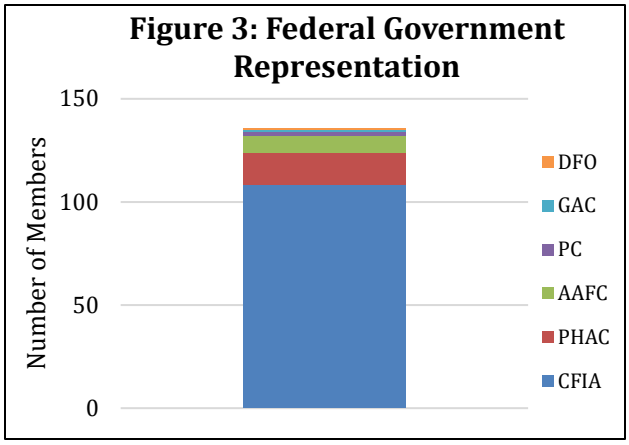
Figure 1: CEZD Member Composition

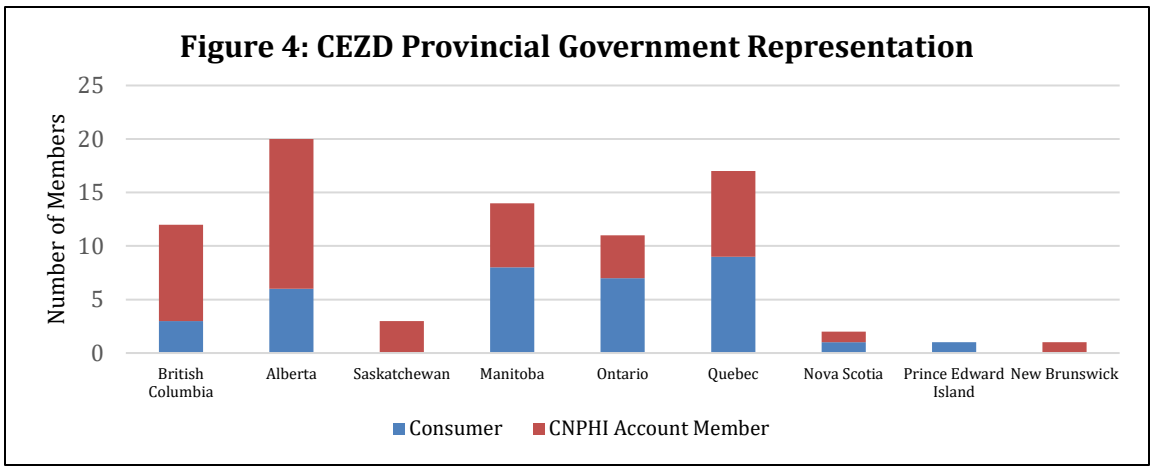


CEZD members belong to a variety of fields, including: federal, provincial, and municipal government, industry, academia, veterinary practice and other service provision, as well as a separate category for retirees who wish to remain involved. **Figure 2: CEZD Community Demographics** displays the percentage of individuals belonging to each of these demographic groups. Over the last year, all demographic groups, with the exception of municipalities, experienced increases in membership. However, the majority of new members came from federal government organizations as well as veterinary practice and other service providers.

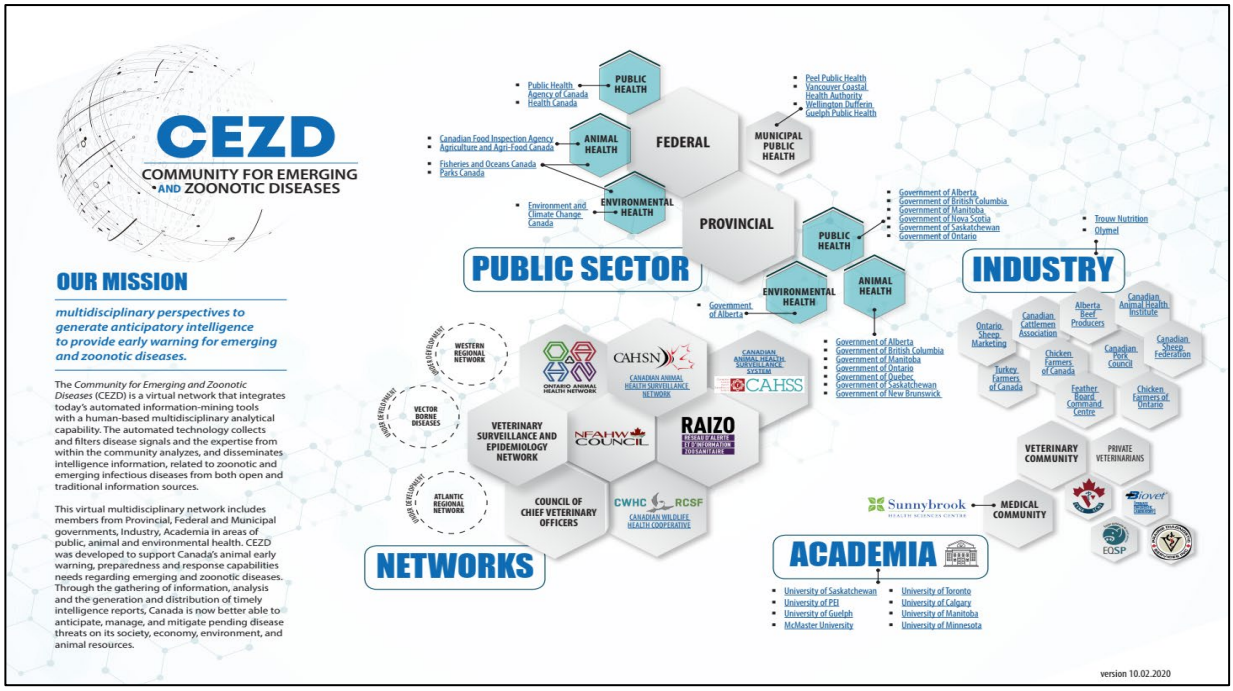


Figures 3 and 4 provide a more detailed depiction of the make-up of the federal and provincial government categories. **Figure 3: Federal Government Representation** displays the number of members belonging to each of the federal government organizations involved in CEZD. The majority of federal government members are from the CFIA (with a membership increase of ~18% from the previous year), followed by Public Health Agency of Canada (PHAC) and Agriculture and Agri-Food Canada (AAFC), with one member each from Parks Canada (PC), Global Affairs Canada (GAC), and Fisheries and Oceans Canada (DFO). **Figure 4: Provincial Government Representation** depicts the number of members from each province and demonstrates CEZD's geographical reach within Canada. Provincial representation has remained steady over the last few years, however there is a need for greater involvement from the territories.





To conclude the member demographics section, **Figure 5: CEZD Stakeholder Map** provides an updated display of CEZD's organizational membership categorized into the following groups: public sector/government, networks, industry, and academia.



CEZD Activity Update

In an effort to engage members within the CEZD, a variety of activities were conducted throughout the year, including: pings, community teleconferences, webinars, scenario discussions, group notification of items of interest, and introductory demonstration sessions. Participation in CEZD's activities also qualifies for continuing education credits for veterinarians in specific provinces.

Ping Questions:

Ping questions are sent to the community on a weekly basis to obtain rapid feedback on signals of particular interest. Ping questions remain very successful, with anywhere from 20 to 35 members rating and/or commenting on their relevance within 48 hours. Hence they are a great way to collect timely feedback on specific issues of concern/interest. Over the last year, 33 ping questions were sent out to community members. Members are also encouraged to submit any questions they may have to the community in the form of ping.

Monthly Community Teleconferences:

The monthly community teleconferences assist with community management and bring together partners across federal and provincial governments, industry, and academia. Ten monthly teleconferences were held during the last year. Monthly teleconferences are also used to discuss ping questions and possible next steps when required.

Scoping Meetings:

Scoping meetings are held as a result of high ratings from ping questions, or by request from CEZD members. The meetings bring together a small group of subject matter experts to determine CEZD's next steps in relation to a specific disease event.

Meetings were organized this year on two important signals, pseudorabies in the US and *Streptococcus zooepidemicus* in North America (US & Canada). For pseudorabies, the resulting action identified was to continue monitoring the cases occurring in the US. However for *Streptococcus zooepidemicus* a meeting summary report was created and distributed to provide an update of the current status of on cases occurring in various animal species throughout Canada.

Webinars & Working Groups:

No webinars were held throughout this year, and the working group meetings [Reporting & Analysis Workgroup (RAW), Outreach Engagement Workgroup (OEW)] were not active. This is due to an increased focus on the domestic pilot and its processes.

Domestic Pilot:

Sharing non-public domestic disease information has been a long standing request from multiple members of the community. The intention of the domestic pilot project is to move the processes of domestic signal identification and communication further upstream. However, to do this, specific practices and procedures must be in place. To work through these procedures, CEZD has drafted a number of domestic disease simulation scenarios.

Over the last year, two simulation scenarios were completed on the suspected introduction of the Asian Long Horned Tick; the first in Ontario and the second in Alberta. The completion of these scenarios provided an understanding of the domestic network make up, regulatory authorities, information sharing processes, and identification any existing gaps in each of the provinces. A summary report of each scenario has been provided to its participants. The next steps on the domestic pilot are to proceed with conducting more scenarios as well as drafting the policy and procedures for domestic non-public signals in preparation for the next phase of the project.

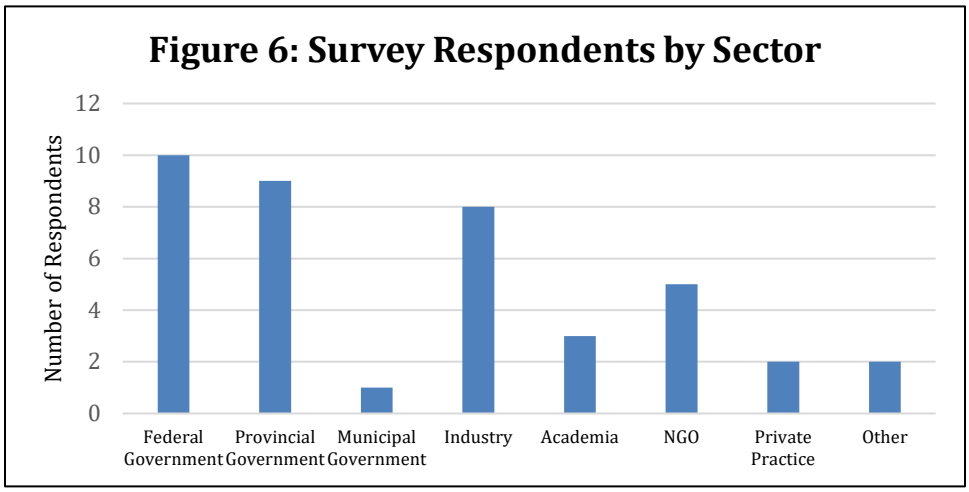
Face-to-face Engagement Meetings:

Unfortunately a face-to-face meeting of the larger community did not occur this year. Instead a number of smaller face-to-face meetings, and a series of online engagement meetings were carried out with each of the specific provinces. The purpose of the meetings was gather feedback on current CEZD activities and prioritize those activities that provide the most value; as well as to discuss CEZD's strategic direction for the coming years. Currently six meetings have been completed, one in each of Ontario, Quebec, Alberta, Manitoba, Saskatchewan, and British Columbia. However, meetings still need to be completed with other members located in the National Capital Region and Atlantic Canada. Once all meetings are completed a final report will be produced and distributed to the CEZD community.

Annual Member Survey

Respondent Demographics:

This year's annual member survey was completed in March 2020. The survey was made available to all 355 members in both English and French and received a response rate of 9.8% (35 respondents). Twenty-two of the respondents identified themselves as being CNPHI account members, while thirteen identified as consumers. **Figure 6: Survey Respondents by Sector** displays the 7 sectors as listed by respondents and closely resembles CEZD's membership structure. Federal and provincial governments were most represented, followed by industry and non-government organizations; meanwhile international members and retirees were absent from the survey responses. Members from other networks and laboratories also responded and are included in the "other" category.



Survey respondents belong to a variety of organizations, including:

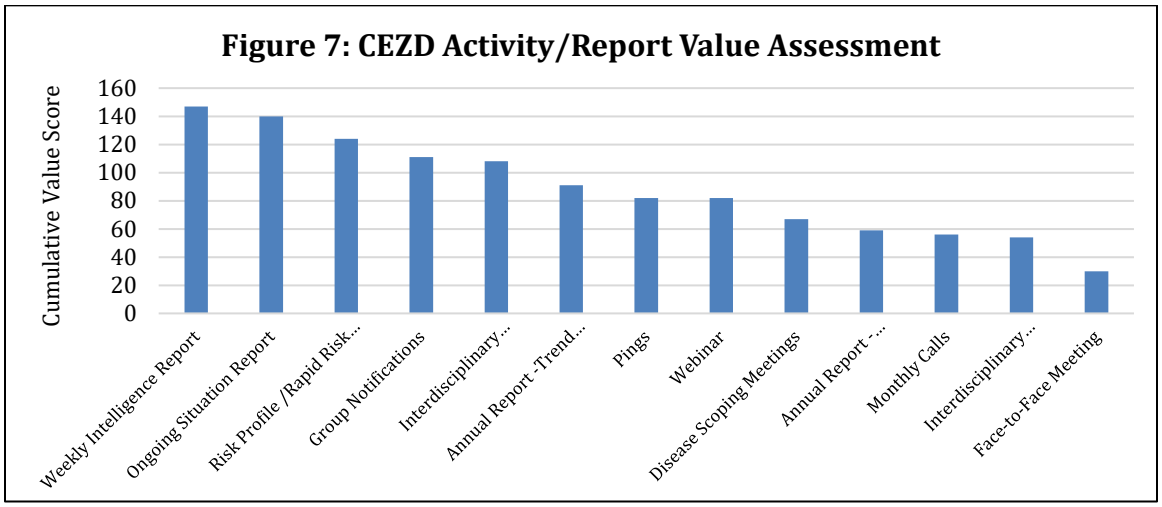
- Canadian Food Inspection Agency
- Canadian Animal Health Surveillance System
- Canadian Western Swine Health Intelligence Network
- University of Guelph
- University of Ottawa
- Parks Canada
- Alberta Agriculture and Forestry
- Alberta Environment and Parks
- Ontario Ministry of Agriculture, Food and Rural Affairs
- British Columbia Ministry of Agriculture
- Zoetis Canada
- New Life Mills
- Prairie Diagnostic Services
- Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec
- L'Équipe québécoise de santé porcine

CEZD Value:

When evaluating CEZD's value, 33/35 respondents indicated that CEZD provided them with valuable information relevant to their current position. The majority of respondents acknowledged that CEZD's value comes from the weekly intelligence reports providing regular updates on disease outbreaks. Likewise, multidisciplinary discussions that bring together various disease specialists, risk managers, and other professionals to encompass a One Health approach were viewed as very valuable. Ping questions were also mentioned

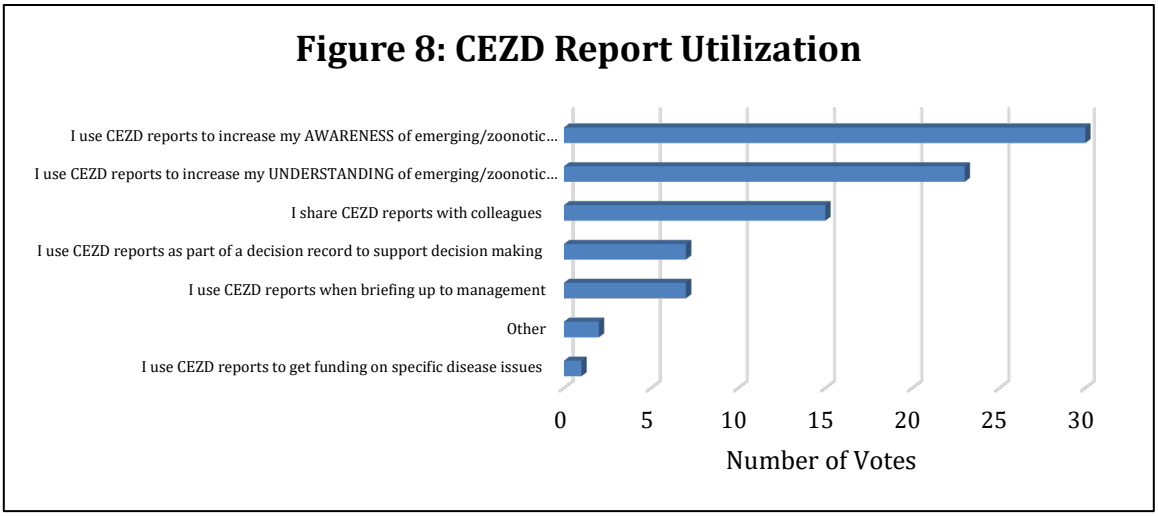
as they allow members to have a timely discussion on disease events via poll comments and bring forth interesting issues. Other CEZD activities members found to be of value include: webinars, annual face-to-face meetings, ASF reports, and risk profile/risk assessments.

Figure 7: CEZD Activity/Report Value Assessment organizes CEZD activities/reports according to the cumulative value score as provided by the survey respondents. These cumulative value scores match up closely with respondents comments. The results display that disease focused activities and products are most valuable, meanwhile activities geared towards community maintenance such as the face-to-face meeting and monthly calls are viewed as less valuable. However, it must be noted that community maintenance activities are attending by a small group of members and therefore provide value to only those that attend.



CEZD Report Utilization:

CEZD reports are mainly used to increase individual awareness and understanding of emerging and zoonotic disease issues. **Figure 8: CEZD Report Utilization** reveals the ways by which CEZD reports are used by community members. Approximately 50% of respondents share the reports with their colleagues, and 25% use them for decision



making or when briefing up to management. Those who choose "other" stated that they do not use the reports, or use the information when creating their own reports. Finally, one respondent uses the reports when applying for funding on specific disease issues.

KIWI Technology

From April 2019 to March 2020, a total of 25 different individuals representing 25 different organizations logged in to KIWI and rated signals within the zoonotic and emerging disease program. **Figure 9: KIWI Information Filtration Process** reveals that during this period, the KIWI technology filtered through 30,350 Individual Information Pieces (IIPs) from CEZD's 21 automatic information sources. It provided a total of 7,398 Anticipatory Intelligence Signals (AISs) to the community for rating; with the community selecting 558 signals as relevant Early Warning Signals (EWSs).
The average number of individuals rating a signal was 6, but ranged anywhere from 1 to 12. For a detailed monthly breakdown of the signal filtration process please review **Table 1: April 2019 – March 2020 KIWI Signal Filtration.**

Figure 9: KIWI Information Filtration Process

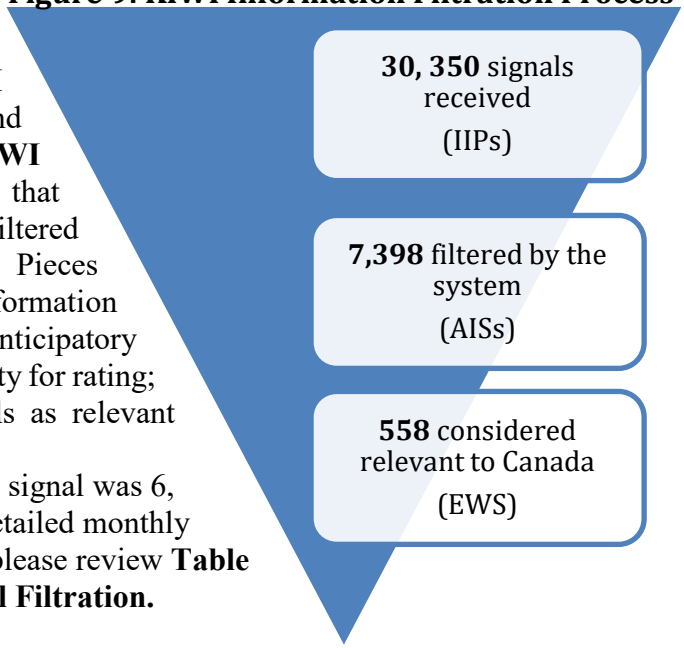


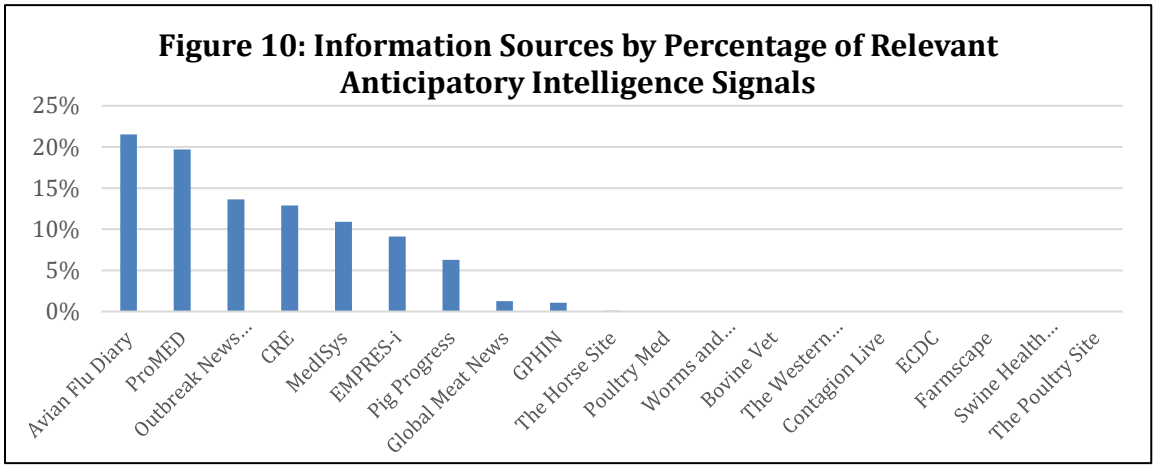
Table 1: April 2019 – March 2020 KIWI Signal Filtration

Month	Number of AISs	Automatic AISs	Manual AISs	Community Reported Events	Number of EWSs
April 2019	1105*	967	107	31	56
May 2019	533	395	106	32	44
June 2019	417	298	94	25	28
July 2019	517	360	124	33	48
August 2019	486	374	88	24	38
September 2019	435	313	102	20	42
October 2019	472	331	120	21	30
November 2019	428	294	91	43	17
December 2019	356	239	73	44	14
January 2020	796	684	77	35	187
February 2020	890	760	94	36	32
March 2020	963	865	83	15	22
Total	**7398**	**5880**	**1159**	**359**	**558**

*The inclusion of GPHIN for 2 weeks in April caused an influx of AISs

Information Source Anticipatory Intelligence Signal Production

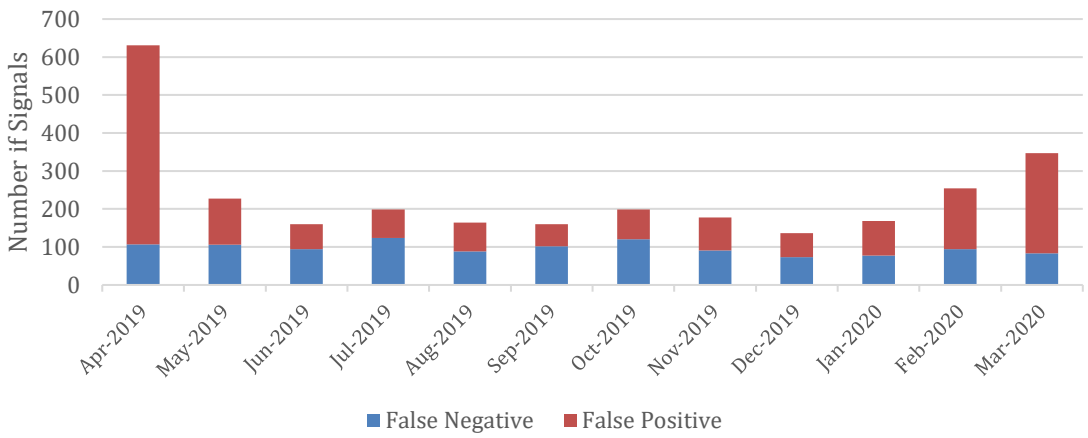
The CEZD emerging and zoonotic program within the KIWI technology currently subscribes to 21 open disease information sources and one closed source. A list of these sources is available in Appendix I – CEZD Information Sources. Additionally, the KIWI technology also gathers disease incident information from outside sources in the form of Community Reported Events (CREs). Examples of outside sources include: the United States Animal Health Association, Ontario Farmer, International Biosecurity Intelligence System, Feedstuff, Flutrackers and Google News. **Figure 10: Information Sources by Percentage of Relevant Anticipatory Intelligence Signals** displays the percentage of relevant AISs coming from CEZDs information sources. Information sources that did not provide relevant signals, as rated by the community, are not listed in this figure. This year, Avian Flu Diary accounted for the largest amount of relevant signals, followed by: ProMED, Outbreak News Today, CREs, MediSys, EMPRES-i, and Pig Progress. Each of the other sources mentioned had less than 5 relevant signals.



Anticipatory Intelligence Signal Specificity & Sensitivity

Figure 11: Monthly False-negative & False-positive Anticipatory Intelligence Signals displays the percentage of false-negative and -positive signals coming into KIWI each month. False-positives are automatic signals that achieve an average rating of 1 (not relevant), while false-negatives are IIPs that were not identified by the algorithm but by analysts and achieve and average rating greater than 1. From April 2019 to March 2020, 22.4% of signals coming in for community rating were classified as false-positives, while 15.6% were false-negatives. When compared to the previous year, a decrease of ~7% is observed in the false-negative signals, with a 4% increase in the false-positives. The increase in false-positives is attributed to the month of April where GPHIN was introduced as a source for a 2-week period, in which ~400 non-relevant signals entered into the system. An increase in false positive signals is also seen in February and March 2020 due to COVID-19-related research and response efforts.

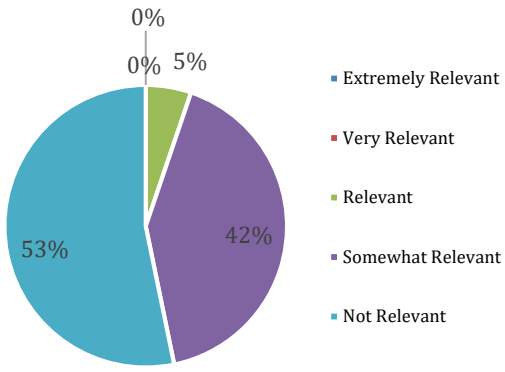
Figure 11: Monthly False-negative & False-positive Anticipatory Intelligence Signal Production



Anticipatory Intelligence Signal Relevancy

Figure 12: Anticipatory Intelligence Signal Ratings April 2019 – March 2020 outlines the percentage of signals falling into KIWIs relevance categories. Within KIWI, the CEZD rates AISs on a scale of 1 to 5, 1 being not relevant and 5 being extremely relevant. A relevancy assessment tool is provided to assist with the rating process. This year, no signals achieved a rating of extremely relevant (5) or very relevant (4). However, plenty of signals rated >3.5; these signals were related to the ASF in Asia as well as the COVID-19 pandemic. The majority of signals have an average rating of not relevant (53%) or somewhat relevant (42%), with only 5% of signals rated as relevant.

Figure 12: Anticipatory Intelligence Signal Ratings April 2019 – March 2020

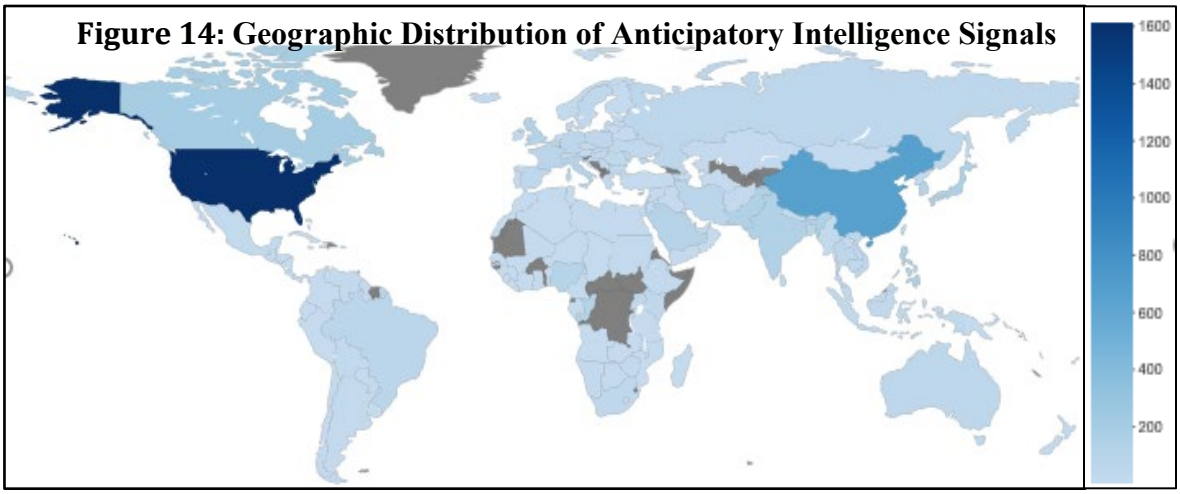


Geographic Distribution of Anticipatory Intelligence Signals

From April 2019 to March 2020, KIWI has received AISs from 168 different countries. **Figure 14: Geographic Distribution of Anticipatory Intelligence Signals** presents the density of KIWI signals across the world. The highest frequency of signals occurred within the USA (1,616), followed by China (669), Canada (200), Japan (159), Philippines (149), Pakistan (142), India (133), Democratic Republic of Congo (124), Saudi Arabia (112), Italy (111), Nigeria (106), and South Korea (104). Other noteworthy countries with 50+ signals include: UK, France, Iran, Bangladesh, Brazil, Australia, Germany, Thailand, Belgium, Russia, Vietnam, and Poland. The high prevalence of USA based signals is mainly due tothe information sources used, as the majority of them are based in the USA and therefore relay disease events from their location more frequently. While African swine fever is

responsible for the majority of signals in the Asian and European countries, COVID-19 has also contributed greatly to these signal counts.

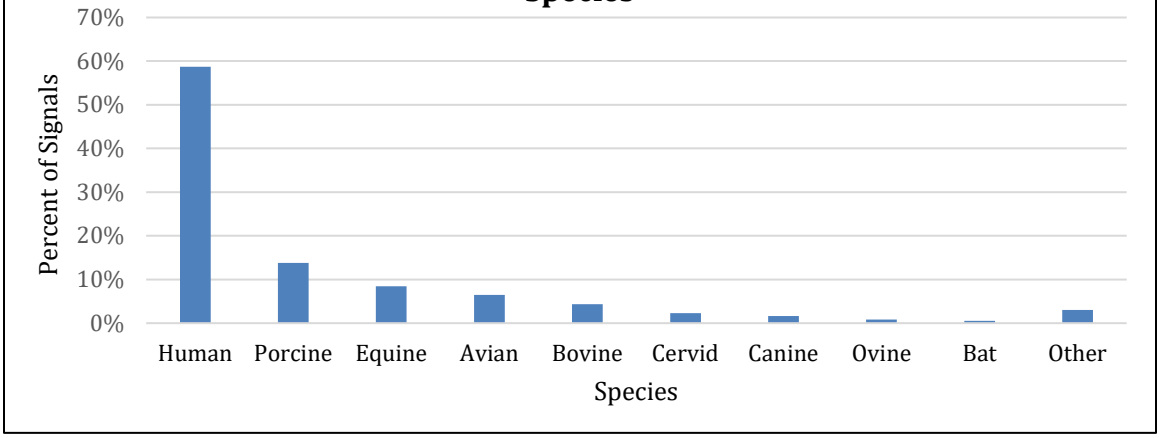
Figure 14: Geographic Distribution of Anticipatory Intelligence Signals



Categorized Anticipatory Intelligence Signals

A breakdown by the species affected in each signal reveals that the majority of signals (59%) were affecting humans, a 10% increase from the last year, mainly attributed to the emergence of COVID-19. Other key affected species include: porcine (14%), equine (8%), avian (6%), and bovine (4%). While the percent of signals may have slightly changed, the top 5 affected species are the same as from the previous year. For more information **Figure 15: Anticipatory Intelligence Signals by Affected Species** displays the percentage of signals affecting each different species over the last year.

Figure 15: Anticipatory Intelligence Signals by Affected Species



*Other category includes: feline, goat, fox, rodent, seal, skunk, camel, bear, bee, buffalo, elephant, primate, hippopotamus, snake, turtle, dolphin, and fish.

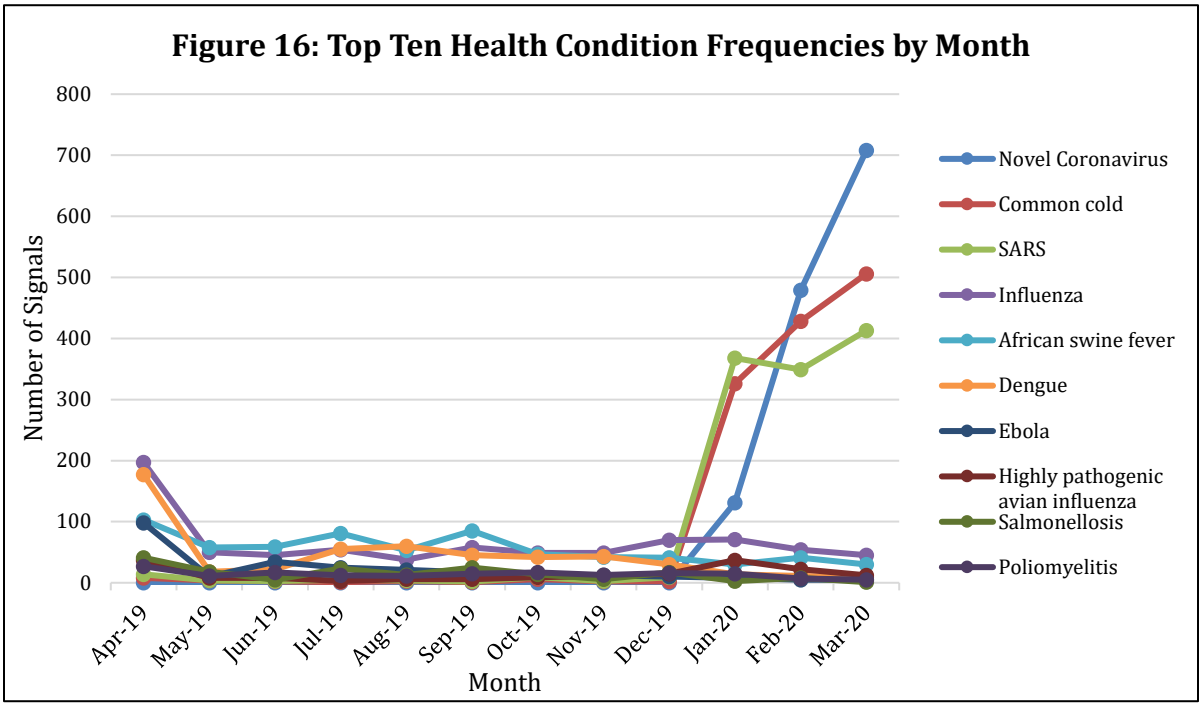
Anticipatory Intelligence Signal Trends

The top 5 most frequent health conditions from April 2019 – March 2020 were: Novel coronavirus, common cold, SARS, influenza (including: low pathogenic avian influenza, swine influenza, equine influenza, human influenza...etc.), and African Swine Fever (ASF). However, based on the dictionary structure and use of synonyms the top three conditions (novel coronavirus, common cold, and SARS) are all referring to the COVID-19 pandemic. **Table 2: KIWI Most Frequent Health Conditions** lists the AIS frequency counts of the top ten most frequent KIWI Health Conditions of the year.

Table 2: KIWI Most Frequent Health Conditions

Rank	Health Condition	Number of Signals
1	Novel Coronavirus	1318
2	Common Cold	1280
3	SARS	1183
4	Influenza	780
5	African Swine Fever	670
6	Dengue	526
7	Ebola	257
8	Highly Pathogenic Avian Influenza	174
9	Salmonellosis	174
10	Poliomyelitis	166

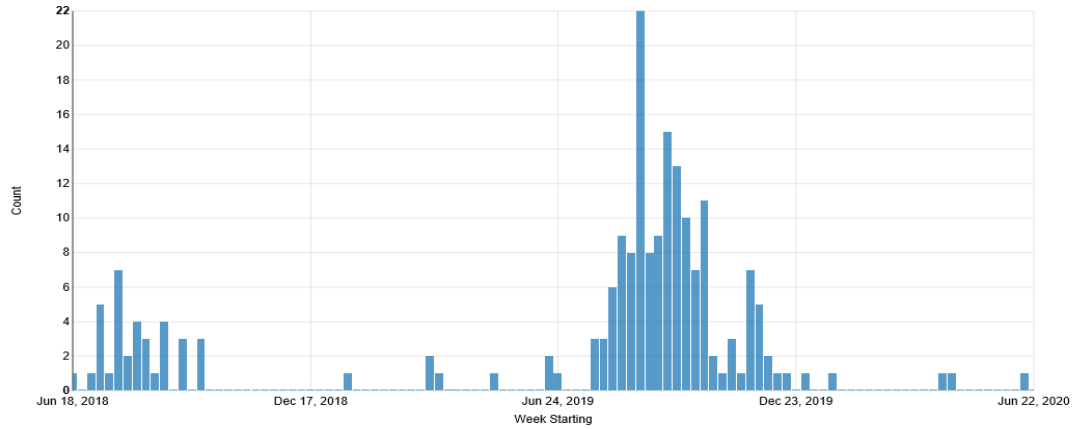
Similarly, **Figure 16: Top Ten Health Condition Frequencies by Month** plots these most frequent health conditions by month to show specific time periods where these conditions occurred. For COVID-19, the increase in reporting began in January, and subsequently the reporting of many other health conditions decreased due to the increased focus on the pandemic.



Disease Frequency Charts

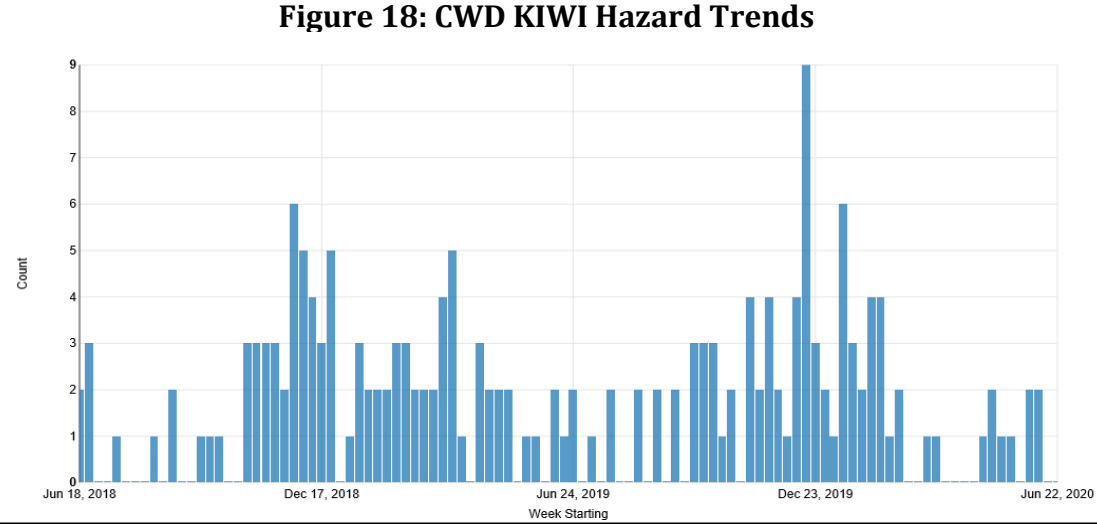
KIWI disease trends provide valuable information in the form of disease signal frequency counts over time. While the trends do not represent case counts, one may infer seasonal patterns or an increase in a particular disease based on the frequency counts and constant number of information sources. In **Figure 17: EEE KIWI Hazard Trends** the weekly frequency counts for Eastern Equine Encephalitis are provided from June 2018 to June 2020. A total of 195 EEE signals entered the system during this time period, however 155 of those signals occurred in 2019 compared to 40 in 2018. Even though it is a seasonal disease, the EEE US cases reported in 2019 were almost 5 times greater than those in 2018.

Figure 17: EEE KIWI Hazard Trends



Similarly, **Figure 18: CWD KIWI Hazard Trends** displays signals relating to chronic wasting disease entering the system from June 2018 to June 2020. A total of 183 CWD signals came into the system during this time, showing a steady increase of signals year over year.

Figure 18: CWD KIWI Hazard Trends



New Notable Disease Events of the Year

Over the course of the previous year the following new events were all rated as relevant to the community and many consisted of a large number of reports: COVID-19 worldwide, Streptococcus zooepidemicus in North America, Eastern Equine Encephalitis in the United States, Porcine Epidemic Diarrhea in Manitoba, and African Horse Sickness in Thailand. **Table 3: New Notable Events of the Year** lists these events, the time they occurred, the average ratings they received and the number of signals.

Table 3: New Notable Events of the Year

Event	Time Period	Average Rating	Number of Signals
COVID-19 worldwide	December 2019 – Present Day	1.00 - 3.90	1857
Porcine Epidemic Diarrhea in Manitoba, Canada	June 2019 – September 2019	2.70 - 3.10	5
Eastern Equine Encephalitis in the United States	July 2019 – December 2019	1.50 - 3.00	145
Streptococcus zooepidemicus in North America	September 2019 – Present Day	1.40 - 3.00	9
African Horse Sickness in Thailand	March 2020 – Present Day	2.30 - 2.80	3

CEZD Going Forward

Going forward into the coming year the following items have been identified by the community as key priorities for 2020-21:

Enhanced weekly intelligence report

- Implement and continue production of the enhanced intelligence report
- Gather community feedback and review bilingual report options
- Automate the analysis required to prepare the report

Rapid Risk Assessments

- Pilot COVID-19 and animal risk assessments
- Review COVID-19 rapid risk assessment process and revise procedures

Domestic pilots

- Review policy and procedures around domestic signals in light of 2019-20 pilot projects
- Consider additional focussed pilots to enhance domestic intelligence

Expand CEZD to include Aquatic Diseases

- Define community structure and responsibilities
- Incorporate aquatics dictionary and review information sources

CAHSS Collaboration

- Build CEZD microsite associated with CAHSS website
- Provide emerging disease verbal reports at CAHSS network meetings

CEZD Engagement

- Complete engagement meetings to finalize CEZD direction for the year
- Review CEZD member roles

Appendix I: CEZD Information Sources

CEZD INFORMATION SOURCES
MEDISYS
OUTBREAK NEWS TODAY
PROMED
THE POULTRY SITE
AVIAN FLU DIARY
CONTAGION LIVE
ECDC
EMPRESS-I
SWINE HEALTH INFORMATION CENTRE
FARMSCAPE
GLOBAL MEAT NEWS
HEALTHY WILDLIFE BLOG
POULTRY MED
PIG PROGRESS
SWINE HEALTH INFORMATION CENTRE
GLOBAL PUBLIC HEALTH INTELLIGENCE NETWORK*
THE WESTERN PRODUCER
THE HORSE SITE
WORMS & GERMS BLOG
CENTRE FOR INFECTIOUS DISEASE RESEARCH AND POLICY
ONTARIO ANIMAL HEALTH NETWORK
THE CATTLE SITE

***GPHIN** is a closed information source which requires login credentials, the source was disabled from providing AIS's within KIWI due to its large volume of news articles