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ABSTRACT

Researchers and epidemiologists are working to improve the capture of agriculture, forestry, and fishing (AgFF) injuries in a variety of ways. A critical component of any surveillance system is the dissemination of information. The purpose of this paper is to report on a survey conducted with AgFF injury surveillance stakeholders to understand preferred dissemination strategies. The survey was distributed using REDCap via web link to organizational stakeholders, which included advisory board members, safety trainers, industry managers and workers, and research collaborators. In total, there were 75 respondents (21% response rate). Occupation and industry influenced preference in update methods. Regarding the length and breadth of updates, 63% of respondents prefer reports (one to five pages), followed by 57% desiring a summary (less than one page), while only 24% wanted a detailed analysis. Social media and news preferences were also different among stakeholders. Surveillance data were desired for 1) trend analysis, 2) tailoring activities and solutions for education, training, outreach and interventions and 3) for research purposes such as grant proposals and evaluation. The dissemination of injury surveillance data should be tailored to the intended audience. Greater attention needs to be paid to the ways in which we share our findings.

Introduction

Agriculture, Forestry, and Fishing (AgFF) are dangerous industries[1]; not only do they require physical strength and repetitive manual labor, but workers are exposed to the dangers of heavy machinery and tools, unpredictable weather, and an unforgiving natural environment. In 2021, AgFF had the highest rate of fatalities among all private industries at 19.5/100,000 full time-equivalent (FTE), over five times that for the average worker.[1] While it is widely accepted that fatal injury statistics are an accurate representation of worker deaths, there is greater uncertainty regarding non-fatal occupational injuries, especially in AgFF.[2–4]

One of many contributing factors to this is a variety of reporting exemptions for AgFF. Farms with fewer than 11 employees are excluded from the random sampling of the Survey of Occupational Injuries and Illnesses (SOII).[4,5] If we assume that these farms might well be earning less than $100,000 a year, they would represent 82% of farms

in the whole U.S. in 2022.[6] Similarly, industry specific gaps exist for commercial fishing, where the Occupational Safety and Health Administration's (OSHA) jurisdiction ends at the coastline.[7]

Researchers and epidemiologists are working to improve the capture of AgFF injuries in a variety of ways.[8] Existing data has been employed in new ways to track injury. Examples include reviewing hospital records,[9–12] using machine-learning algorithms to search for injuries among pre hospital care reports,[13] commercial fisheries workers' compensation review in the Northwest,[14] scanning news reports via AgInjury News,[15–17] utilizing roadway crash data to understand farm-related motor vehicle injuries[18] and NIOSH Worker Health Charts,[19] to name a few. Active surveillance approaches have also filled in gaps, most often through surveys.[20–22]

A critical component of any surveillance system is the dissemination of information.[23] It is well recognized that users have different needs, and these factors need to be considered in

a dissemination plan.[24] A review on the use of social media and internet-based data for public health, users look to access the most relevant information with the greatest ease.[25]

Data visualization plays a role in the dissemination of public health information, and advancements in this field are increasingly making data accessible to a wider audience. In the U.S., the Centers for Disease Control and Prevention (CDC) have focused on sharing online data, which include data visualizations, reports, graphic fact sheets, and media releases, among others.[26] Efforts in dissemination include data harmonization, the standardization of data content and structure, using minimal human effort, and maintaining privacy and protecting confidentiality of individual data.[26]

In the U.S., policy makers often look for current, up-to-date statistics as well as stories to inform and influence decisions.[27] State legislators often seek data from government sources, advocacy, lobby and industry groups.[27] Research conducted in Canada also points to the importance of establishing networks among researchers and having access to databases of research output.[28] In France, researchers compared two online public health data systems: the first system relied on standard data content and structure, allowing for longevity and sustainability, to support data sharing among large institutions[29]; the second showed no standardization (definitions of data being made from scratch), thus discouraging reusability and interoperability beyond computer scientists. The end user needs to be in mind when building and maintaining a surveillance system. Dissemination requires deciding early how best to present data to end users. In the United Kingdom, research found that public health policymakers mostly used local data from government websites and personal contacts as sources to make decisions.[30] They did not use research evidence directly, nor did they contact researchers or academics. Oliver and de Vocht[30] emphasized the need to build personal relationships with policy makers.

Research dissemination has been studied in terms of what (the message), to whom (the target audience), via what medium (the channel) and how (format).[31,32] For example, a recent Delphi study of expert consensus of occupational health

and safety (OSH) surveillance emphasized data dissemination as a critical component of an ideal OSH surveillance system.[33] Further, this research found that dissemination was a perceived weakness of many current OSH surveillance systems.

Moving research into practice often involves collaborating with people who may benefit most from the research findings and communicating the findings beyond the scientific community.[34–36] The audience for public health information spans peers in academia, public health practitioners, policymakers, government and other agencies, and community partners.[37,38] For the AgFF community, it involves employers and employees alike, as well. The purpose of this paper is to report on a survey conducted with AgFF injury surveillance stakeholders to understand what information is helpful to public health efforts, and in what way the information should be tailored depending on the audience segment.

Methods

A survey tool (available in the supplemental online materials) was developed in the research electronic data capture platform REDCap,[39,40] which allows for direct data collection. Questions were created to capture the use of surveillance information and how it is obtained. These questions were drafted by the surveillance research team, reviewed by the marketing coordinator, and pilot tested by two additional researchers, all of whom regularly interact with stakeholders. Questions included:

- Demographics: birth year, race and ethnicity, industry (current and past) and current occupation
- The use of injury and/or fatality statistics: how data are being used, what has been missing, information delivery preference (method, type, and frequency), from where (state, industry), and usefulness of information
- Obtaining information: social media use (professional and personal) and preferred news outlets

The survey was distributed using REDCap via web link to the Northeast Center for Occupational Health and Safety's stakeholders, which included advisory board members, safety trainers, industry

managers and workers, and research collaborators, related to AgFF in the Northeast region and/or collaborating with our organization. A link to the survey was also posted on our organization's social media feeds. After initial distribution, those who did not respond received a reminder email one week later. The survey was closed after 19 days.

Participants filled out the survey online and responses were directly stored in the REDCap database. Data was exported via csv files and analysed quantitatively in Excel (Microsoft, Redmond, WA) and for free text responses, qualitatively in NVivo 12 (Lumivero, Denver, CO, U.S.). In addition, the free-text responses regarding industry (NAICS 2022) and occupation (SOC 2018) were coded by a research staff member using the NIOSH Industry and Occupation Computerized Coding System (NIOCCS)[41] and post-coding developed at the University of New Hampshire,[42] and reviewed by the lead investigator. NAICS and SOC codes were visually inspected and revised manually to capture adequate detail, when necessary. Given that both NAICS and SOC are hierarchical in nature, codes were grouped to maximize their common digits. Quantitative data analysis included frequency and percentages. Qualitative data analysis was done using a content analysis approach to identify common themes in the responses.

The protocols for this work were approved by the Mary Imogene Bassett Hospital (Bassett Medical Center) Institutional Review Board.

Results

On January 19, 2023, 355 people working within AgFF in the Northeast region and/or collaborating with the Northeast Center were invited to take the survey with a reminder email sent on January 26 and social media posts were published on January 20. In total, there were 75 respondents (21% response rate), with answers peaking on the invitation days. More participants responded after the reminder email over the initial request, with the majority (66%) of surveys completed between 1:30 and 6:30 PM. Of the 75 responses, 60 were complete with the remaining 15 missing certain data points. The results include both complete and incomplete surveys. Table 1 shows the percentage of completeness for each question, which ranges

from 49% to 99%. Approximately two-thirds (63%) of the survey were single or multiple-choice questions which tended to have higher response rates over the open-ended responses.

More than half of the respondents (51%) were born between 1960 and 1979, with 21% of participants before 1960, and 28% after 1979. Less than 5% noted Hispanic ethnicity, and 92% considered themselves as white. The vast majority (97%) were willing to be contacted for future research projects with the most preferred method being e-mail (96%).

Respondents' current industry and occupation are shown in Table 2. The most common industries represented in our sample were Agriculture, Forestry, Fishing and Hunting (31%), Health Care and Social Assistance (16%), Educational Services (16%), Professional, Scientific, and Technical Services (16%), and Public Administration (11%). Within those, Support Activities for Agriculture and Forestry (11%), Administration of Public Health Programs (10%), Research and Development in the Physical, Engineering, and Life Sciences (10%), and Agriculture (6%), Forestry (6%), and Fishing (6%) could be identified as sub-categories.

Grouping occupations into their higher hierarchy leaves five main groups: Life, Physical, and Social Science (21%), Educational Instruction and Library (17%), Management (14%), Life, Physical, and Social Science Technicians, All Other (10%), and Farming, Fishing, and Forestry (10%). Within the five main groups, the following occupations were well represented: Teachers and Instructors, All Other (6%), Farmers, Ranchers, and Other Agricultural Managers (5%), Managers, All Other (5%), Training and Development Specialists (5%), Occupational Health and Safety Specialists (5%), and First-Line Supervisors of Farming, Fishing, and Forestry Workers (5%).

Use of surveillance data for work purposes

Figure 1 shows the states for which respondents sought information. Over half of respondents (54%) were interested in a single state; however, 17% desired data from all Northeast states. Additionally, respondents also noted an interest in data from outside the Northeast region.

Of the three industries injury data from agriculture and forestry were most preferred, at

Table 1. Completeness of questions asked (*n* = 75).

Question	Percentage of completeness (%)	Free text question?
What year were you born?	95	
Are you Hispanic?	99	
Which one or more of the following would you say is your race?	97	
May we contact you for future research projects?	99	
What is your preferred method of contact?	96	
Do you currently use injury or fatality statistics in your work?	87	
How do you use them?	61	Yes
What has been missing from the data you currently use that you would find helpful?	49	Yes
For which state do you want to receive information?	84	
Check the industries you are interested in receiving updates from:	84	
What is your preferred method to receive the update:	84	
How frequently would you like to receive updates?	84	
What would you like to see? (number of pages)	84	
How would this information be useful to you?	61	Yes
Would you like to receive our organization's newsletter?	84	
In which industry do you work?	84	Yes
What is your current role in the industry?	84	Yes
How many years have you worked in your current role?	84	
How many years have you worked within this industry?	84	
Have you always been within this industry?	83	
Please tell us what you did before:*	100	Yes
What social media platforms do you use (personally)?	81	
What social media platforms do you use (professionally)?	80	
How do you get news?	81	
Please list the top 3 places you get news from: 1	81	Yes
Please list the top 3 places you get news from: 2	71	Yes
Please list the top 3 places you get news from: 3	60	Yes

*n = 30 for this question, as it depended on the answer of the previous one.

65% and 62% respectively, with fishing being an interest for 44% respondents. Most respondents (54%) sought data for a single industry only, with a quarter wanting information for all three industries. The most common combination however, was for agriculture and forestry.

Figure 2 shows the proportion of preferred method to receive surveillance updates. About half of respondents (51%) preferred a single method, while 22% preferred three ways of receiving information. Nearly half (46%) preferred a quarterly update, followed by semi-annually (40%), and annually (21%). Regarding the length and breadth of document, 63% of respondents prefer reports (one to five pages), followed by 57% desiring a summary (less than one page), while only 24% wanted a detailed analysis. Two-thirds of respondents preferred only one document length, while 22% wanted two options.

Various occupations showed different preferences in update methods. Managers (e.g. safety managers or forest service managers) had an equal split between infographics (22%) and searchable databases (22%). Whereas scientific technicians (33%) preferred to read infographics alone. Print newsletters were preferred by scientists (33%) and farming, forestry, and fishing workers (57%). Searchable databases were the favorite of teachers and librarians (e.g. agricultural teachers and research librarians) (30%). Quarterly updates were the preference of scientists (54%), teachers and librarians (50%), and farming, forestry, and fishing workers (50%). Managers showed a partiality for semiannual updates (45%). Annual updates were the preference for scientific technicians (50%). Single page updates were ideal for managers (50%) and scientists (47%). Short reports (one to five pages) were the preference for scientific technicians (63%) and farming, forestry, and fishing workers (50%). Teachers and librarians equally favored single page updates and short reports (40%).

Breaking down preferences by industry reveal patterns different from occupation, and these are noted in Figure 2 using icons. The public administration industry values both infographics and full reports (29%). AgFF has a stronger preference for infographics alone (28%). Print newsletters were the

Table 2. Percentage of respondents working at different industries with their current occupations.

| Occupation (SOC 2018) [a]	Industry (NAICS 2022) [b]								
	11	221114	321	51	541	611	62	813312	92
11–0000	**6%**				2%		2%	2%	3%
13–0000	3%	2%				2%	2%		
15–0000				2%					2%
19–0000	5%		2%		**8%**		3%		3%
19–4099					**6%**	2%	2%		
21–1000	2%						2%		3%
25–0000	3%					**13%**	2%		
27–3041				2%					
29–1000	2%						3%		
43–4000	2%						2%		
45–0000	**8%**		2%						

Note: Industry and occupation combinations that represent five percent or more of the respondents are bolded.
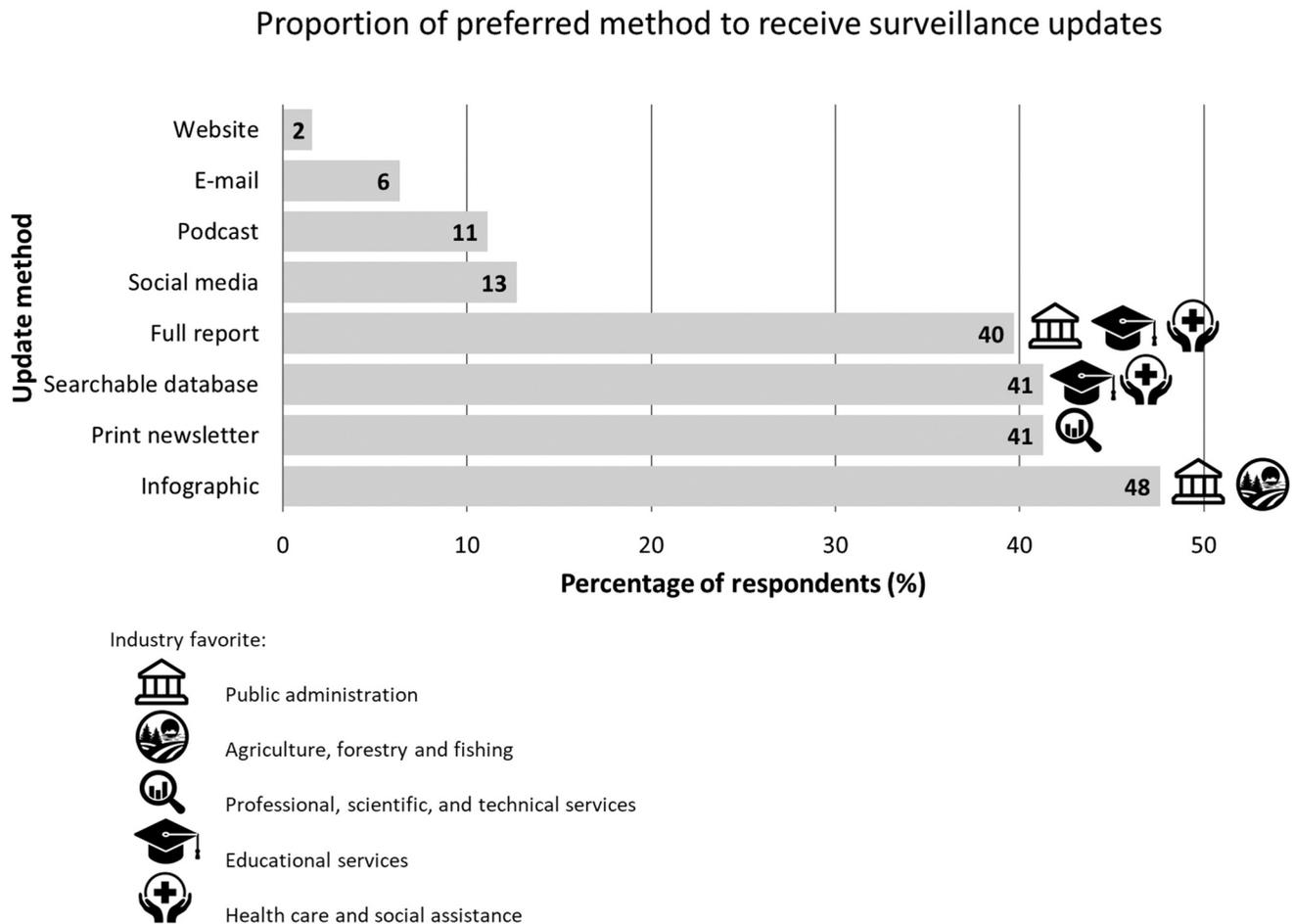[a]Occupation codes correspond to the following.
  • 11–0000 Management
  • 13–0000 Business and Financial Operations
  • 15–0000 Computer and Mathematical
  • 19–0000 Life, Physical, and Social Science
  • 19–4099 Life, Physical, and Social Science Technicians, All Other
  • 21–1000 Counselors, Social Workers, and Other Community and Social Service Specialists
  • 25–0000 Educational Instruction and Library
  • 27–3041 Editors
  • 29–1000 Healthcare Diagnosing or Treating Practitioners
  • 43–4000 Information and Record Clerks
  • 45–0000 Farming, Fishing, and Forestry
[b]Industry codes correspond to the following.
  • 11 Agriculture, Forestry, Fishing and Hunting.
  • 221114 Solar Electric Power Generation.
  • 321 Wood Product Manufacturing.
  • 51 Information.
  • 541 Professional, Scientific, and Technical Services.
  • 611 Educational Services.
  • 62 Health Care and Social Assistance.
  • 813312 Environment, Conservation and Wildlife Organizations.
  • 92 Public Administration.

States for which respondents want information
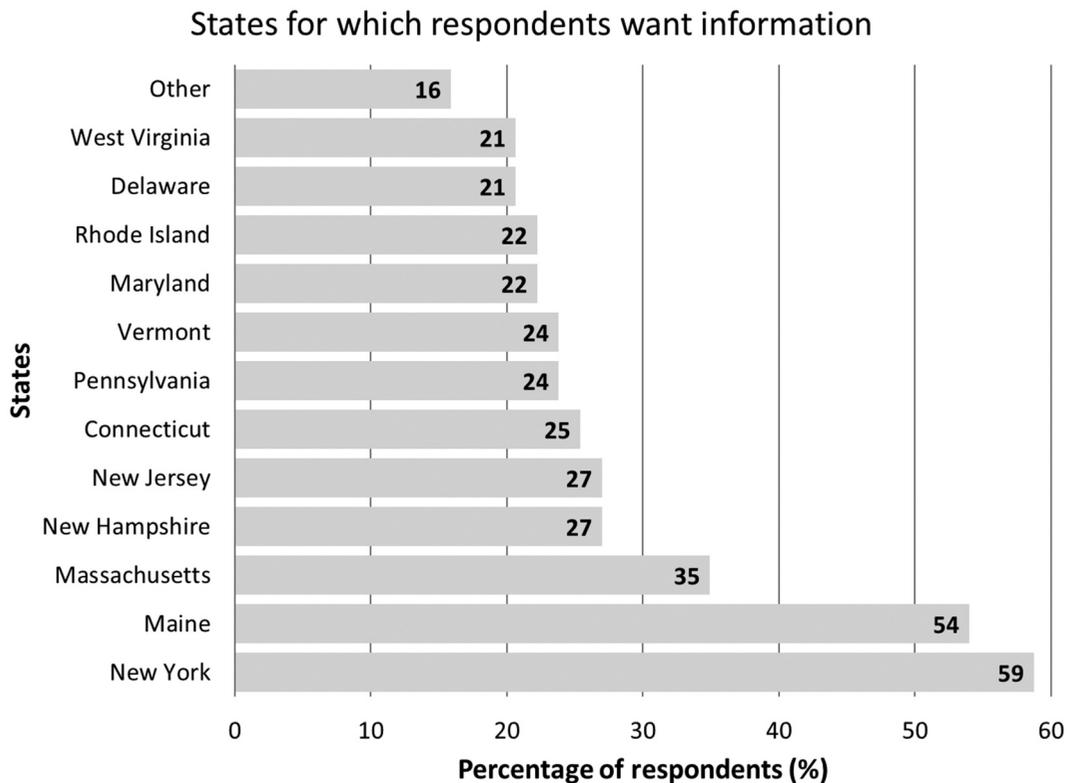
Figure 1. Percentage of respondents that wish to have information for a given state.

Proportion of preferred method to receive surveillance updates

Figure 2. Percentage of respondents with their preferred update method.

preferred standard for professional, scientific, and technical services (24%). More detailed sources such as searchable databases and full reports were the ideal for educational services (29%), and the health care and social assistance industry (31%). All industries preferred quarterly updates with the exception of the healthcare and social assistance industry, which wanted semiannual updates.

For those who currently use injury or fatality statistics in their work, free text responses to the questions of "How do you use them?" coalesced around three main topical areas: 1) trend analysis, 2) tailoring activities and solutions for education, training, outreach and interventions and 3) for research purposes such as grant proposals and evaluation. Stakeholders noted several limitations to data currently available. These ranged from wanting better industry and occupation information, wanting more up-to-date information, and desiring data analysis on causation and association.

News consumption

A comparison of the proportion of respondents using social media for personal and professional use is seen in Figure 3. Facebook was most popular and used at a similar rate for personal and professional purposes. For personal use, most (41%) use only one type of social media, while 20% use two social media platforms. Professionally, the use of a single social media platform is 53%, followed by the use of three social media platforms at 27%. Instagram and YouTube were most popular for personal use, whereas LinkedIn was used more for professional purposes.

The methods of obtaining news are shown in Figure 4. More than half (51%) obtain news through two or three sources, and 36% rely on one source alone. When asking respondents to share their favorites within the beforementioned categories, the following were the most popular via free-text (though not an exhaustive list):
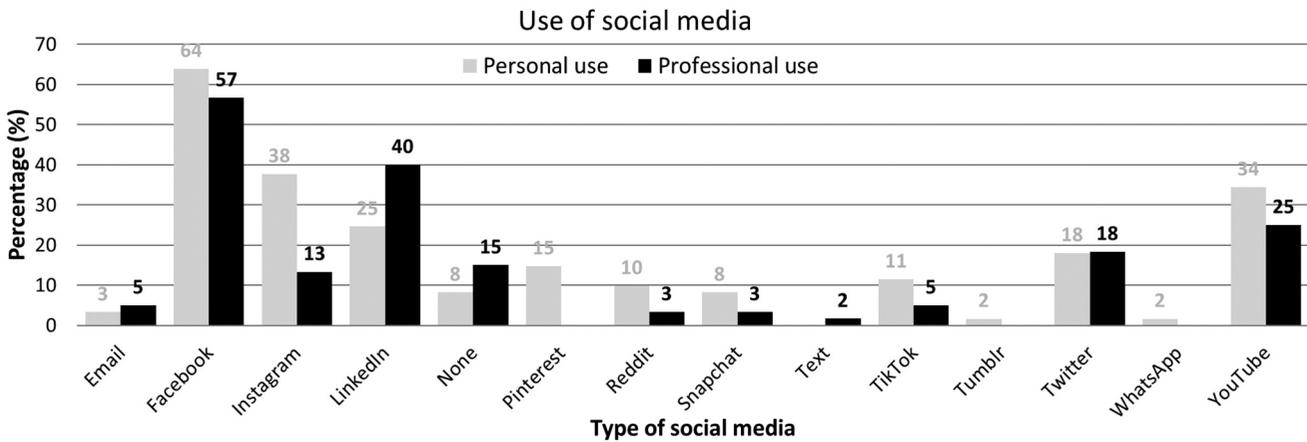
Use of social media

Figure 3. Comparison of the proportion of respondents using social media.

newspapers (New York Times and Washington Post), magazines (The Atlantic and Northern Logger), TV subscriptions (Hulu, local news, and Spectrum news channels), social media (Facebook and Twitter), radio (NPR), and podcasts (of which NPR podcasts stood out as a popular choice).

Discussion

Our response rate of 21% was similar to other recent occupational health and safety surveys.[21,22] The respondents were a convenience sample, so the results may not be representative of all occupations and industries that would have a stake in injury surveillance data of this kind. Therefore, certain occupation and industries may be over- or underrepresented in the results. The length of this survey likely had an influence on a respondent's willingness to complete it in full, as shown in Table 1. The survey was reviewed and tested before the survey was distributed, but the way in which questions were posed could have influenced the quality or quantity of responses. For example, respondents seemed to find it easier to click on possible responses rather than writing free-text responses.
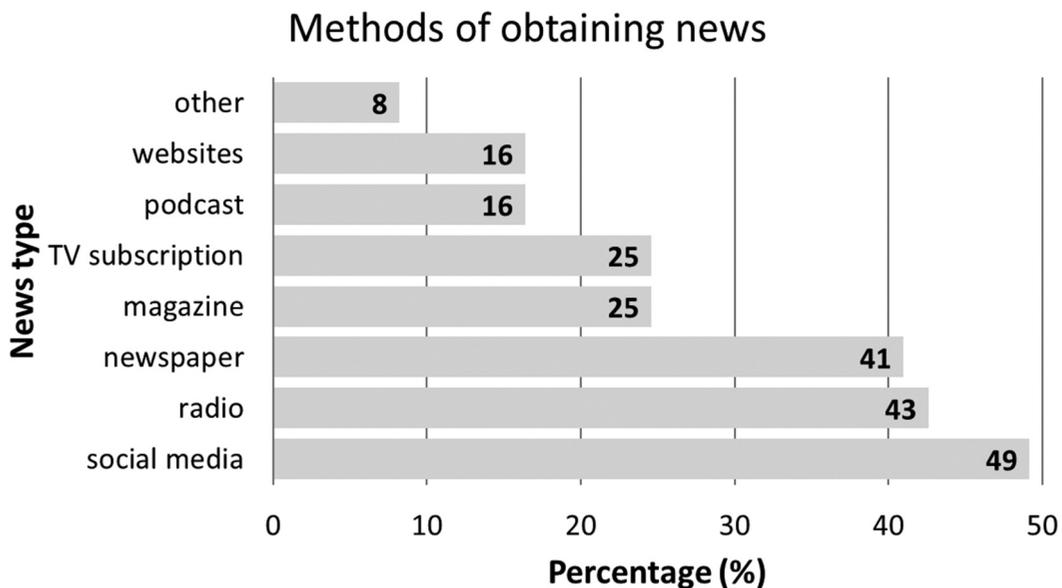

Figure 4. Methods of obtaining news.

Even though this was a convenience sample, we had a wide variety of industries and occupations (I/O) represented in the data, ranging from AgFF workers and managers to public health officials and data scientists. This diversity of respondents how that surveillance data is valued by not only public health professionals, but is also critical to industry, government and academia. Given the variety in industry and occupation, the NIOSH Industry and Occupation Computerized Coding System (NIOCCS) was beneficial in categorizing the free-text responses. It was necessary for us to complete additional post-coding[42] and visual inspection because the accuracy of NIOCCS is dependent on the quality and amount of input data.[43]

Due to the way NIOCCS was designed, it does not regularly code industry to the 6th digit, but rather the 4th.[44] Therefore, additional clean-up was necessary for industry classifications. That generated additional visual inspection, but given that NIOCCS provided the 4th digit code, human coder could more easily assign the more detailed NAICS 6 digit codes for 30% of the records. However, using NIOCCS significantly reduced the time it would have taken to do this all by hand.[45]

While respondents sought data from all areas of the Northeast, the greatest interest in New York, Maine, and Massachusetts, was likely influenced by the fact that our organization has the greatest presence in these states. The relative ranking of the other states can help us target data dissemination through our Northeast Ag Safety and Health Coalition (NEASHC), a professional development and networking program for farm safety and health educators throughout the Northeast. In addition, information was requested from all Northeast states and areas outside of the Northeast region, which points to the need for a cohesive national surveillance system.[8,46]

Data dissemination and diffusion is contingent on tailoring the information to suit the needs and wants of our audience. The results of this study point to the need to develop a variety of resources and publications. For instance, infographics have been and will continue to be a critical way to share information in a compact, quick manner, which is favored by workers and managers alike. The variety of options created will need to be balanced with available staff time and funding.[30] The fact that public administration professionals, which are likely to be advising policy makers, favor both infographics and full reports could be an indication of policy makers wanting high-level overviews due to time constraints, and the advisors' need to summarize their own findings, respectively.

While we had good representation across industries and occupations, we are missing responses from policy makers. Focusing on building relationships with decision makers for the purposes of sharing data will be an important way to see that occupational injury is valued and addressed.[28–30] Given that legislators would welcome a centralized entry point for information, part of our strategy could include networking with policy makers, but also creating searchable, customizable databases and compelling infographics.[29]

Overall, the preferred types of publications and desired detail varied by industry and occupation. Further, the type and length of a publication are associated with each other; for example, infographics are usually one page long, and many print newsletter are typically one to five pages. It was interesting to see that AgFF workers generally wanted more detailed information over AgFF managers. This points to incorporating more specific detail into worker safety trainings, while providing summary style overviews for managers. There was an overall desire for more timely data and more frequent dissemination of information. However, while we have control over how quickly we process surveillance data based on available staff time and streamlining systems, we do not have control over the timeline and availability of certain datasets (e.g. hospital data or PCR data).

Understanding what social media platforms and news outlets are favored allows us to target where we place information in the future. We have had success in disseminating research via more popular platforms in the past, such as newspapers, trade journals, and radio, and will continue to seek out continued opportunities for this. Beyond that, we can look to those platforms and sources for inspiration on publication design, data

visualization, and tone, as well. While trust in science and data have eroded in recent years,[47–49] we can take steps to repair confidence in public health by providing data that our stakeholders find useful and actionable.[50,51] Part of our mission should be to elevate the voices of research and make it accessible to the general public.

Conclusion

The dissemination of injury surveillance data should be tailored to the intended audience, with a focus on shorter, more digestible materials. This study provides greater detail on how AgFF injury surveillance stakeholders want to use injury data in the context of improving agriculture, forestry, and fishing safety. While the focus has been on the surveillance data collection, greater attention needs to be paid to the ways in which we share our findings.

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