Published in final edited form as:

Zoonoses Public Health. 2011 December ; 58(8): 523–528. doi:10.1111/j.1863-2378.2011.01401.x.

State-level Zoonotic Disease Surveillance in the United States

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Summary

Most emerging infectious diseases are zoonotic, yet recent commissions have highlighted deficiencies in their surveillance. We conducted a survey to understand the needs of state agencies for zoonotic disease surveillance. The findings will hopefully support the development of biomedical informatics applications that can link animal and human data for surveillance.

Keywords

Zoonoses; Population Surveillance; State Government; Medical Informatics; Data Collection

Introduction

The majority of emerging infectious diseases in the past several decades are zoonotic (Daszak *et al.*, 2001, Glickman *et al.*, 2006, Krauss, 2003). There is a growing interest, through initiatives such as One Health (Kahn *et al.*, 2010) and the WHO-OIE-FAO framework (FAO *et al.*, 2008), for an increase in collaboration between the veterinary and human medicine communities. The belief is that knowledge about animal health may serve as an important early warning of a threat in human populations (and vice versa).

Public health surveillance plays an important role in early identification and reduction of morbidity and mortality. In the United States, much of the efforts for zoonotic disease surveillance are at the state level with either the state public health department for surveillance of human populations, or state agriculture agencies, for surveillance of domestic animals. For human surveillance, many public health departments employ a state public health veterinarian. This individual is trained in veterinary medicine and often epidemiology. Conversely, for domestic animal surveillance, a state department of agriculture often employs a state veterinarian to lead this effort. Each state is different and these appointments are not true for every state.

As part of our initial investigation of the current state of zoonotic disease surveillance systems, we conducted a qualitative study at the state level, which identified areas for improving this process (Scotch *et al.*, 2011). State veterinarians and state public health veterinarians across the six New England states (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut) were interviewed. Here, we expand on this work and describe an electronic survey to state agencies outside of New England. The survey will enhance our understanding of the challenges of integrating animal and human

zoonotic disease data, and may support the subsequent development of biomedical informatics applications to support this process.

Materials and Methods

We created a survey to assess zoonotic disease surveillance at agriculture and health departments across the United States. The knowledge gained from the qualitative interviews was used to draft an initial set of survey questions. Then, a Delphi process (Deshpande *et al.*, 2005, Kahan *et al.*, 1994) was used to gain feedback and reach consensus on the survey questions from some of the New England state public health veterinarians and state veterinarians from our previous study. The questions focused on how reportable disease data is obtained, how it is stored, how it is analyzed, the amount of information sharing with other agencies during case investigation, and ways to improve surveillance in the state. Comparison of responses from state public health veterinarians vs. state veterinarians was performed. SPSS 16 (SPSS Inc., Chicago, IL) was used for analysis.

Results

In total, 79 surveys were sent to state public health veterinarians and state veterinarians outside of New England. Contacts and emails were identified from the professional associations of these two groups (The National Association of State Public Health Veterinarians, 2011, United States Animal Health Association, 2011). The final survey contained 18 questions over four surveillance themes including: data management, data analysis, collaboration, and improving surveillance.

Table 1 shows the numbers and response rates for each group. There were 64 responses for an overall response rate of 81% (64/79), and no difference was found between the groups.

Table 2 shows the responses of the two groups. All of the 25 state public health veterinarians indicated that at least some of the zoonotic disease data was stored electronically (question 1), while 62% (24/39) of the state veterinarians indicated this ($p < 0.001$). A difference was indicated in response to the sufficiency of existing tools for analyzing zoonotic disease data (question 7), however, both groups were relatively neutral in regard to whether their tools enable them to sufficiently analyze zoonotic disease data.

Collaboration (questions 8–12), including the sharing of zoonotic disease data between animal and human agencies was an important theme of this survey. No difference was indicated between groups (except for email with the Health Department, #9), with phone and email as the most popular methods. More advanced techniques including biomedical informatics applications to support automated data transfer, were rarely indicated.

Respondents were also asked questions related to methods that potentially could improve surveillance in their state (questions 13–17). This includes use of technologies such as Geographical Information Systems (GIS) that enable for geospatial analysis. Several recent studies have used GIS for zoonotic disease surveillance and risk assessment (Antoniou *et al.*, Carbajo *et al.*, 2009), and use of the technology in public health is common. In our study (question 13), both groups indicated that GIS was important for surveillance, with state veterinarians more enthusiastic than state public health veterinarians ($p = .024$).

Discussion

Since zoonotic diseases are defined as being transmittable between animals and humans, it seems logical that surveillance efforts should involve agency collaboration and data sharing. Initiatives such as One Health (Kahn et al., 2010) and the NAS report (Institute of Medicine

(U.S.). Committee on Achieving Sustainable Global Capacity for Surveillance and Response to Emerging Diseases of Zoonotic Origin. & Keusch, 2009) emphasize the recent acknowledgement of this. Both state public health veterinarians and state veterinarians indicated using mostly *as needed* approaches to collaboration including phone and email. Use of automated systems to link data was low, yet a high percentage of both groups indicated the importance of sharing data across agencies (question 11).

One of the barriers identified from the qualitative survey was that certain data was too sensitive to share with outside agencies (Scotch et al., 2011). This was especially the case with the state veterinarians, who indicated potential risk to the livestock industry. Interestingly, in our survey, more state public health veterinarians acknowledged issues with sensitivity than state veterinarians (question 12). This is likely to do with laws such as the Health Insurance Portability and Accountability Act (HIPAA) that protect patient privacy and the release of health information. Patient privacy is likely a reason for why state veterinarians do not store human laboratory data. Also, federal programs such as the CDC's Public Health Information Network (PHIN) require certain standards for health information exchange (CDC, 2010).

A potential barrier not addressed is the difference in missions between the two agencies based on the populations they serve. For example, health departments are focused on understanding the burdens of disease in people while protecting individual confidentiality. Agriculture agencies, on the other hand, monitor the health threats to companion and livestock animals and impact on the livestock *industry*. These different missions can influence which diseases are reportable and the opportunity to collaborate across these agencies. The similarity between what is reportable for animals and what is reportable for humans is likely influenced by these different objectives. For example, in Utah, we estimated that the State Department of Agriculture has over 90 reportable diseases for animals (Utah Department of Agriculture and Food, 2010) and that the Utah Department of Health has over 60 reportable diseases (Utah Department of Health, 2010). While the majority of emerging infectious diseases are zoonotic, only an estimated 15–20 diseases are included on both lists. This highlights the differences in objectives between the two agencies as well as the challenges to collaboration. For example, some of the food-borne bacterial zoonoses such as *E. coli* 0157 are not reportable in animals (but are reportable in humans), which may be related to the differences between the public health and agriculture agencies. An informatics solution might be to create a linkage between veterinary and human electronic health records. In addition to pulling diagnostic data, electronic information retrieval of syndromes (e.g. respiratory symptoms) and procedures (e.g. tick removal from pets) might compensate for these discrepancies and increase the amount of cross-agency data sharing. With veterinary national chains such as Banfield Pet Hospitals possessing electronic record systems (Glickman et al., 2006), this could represent a valuable initiative.

Finally, we did not consider all aspects of zoonotic disease surveillance including the activities from agencies such as departments of wildlife. Thus, our study cannot be considered a complete understanding of zoonotic disease surveillance at the state level. In addition, we did not ask respondents to answer based on specific surveillance tasks, but rather to generalize their responses. Understanding that surveillance needs can change on a case-by-case basis, there is the potential that this survey does not capture the entire realm of surveillance issues at state agencies.

Acknowledgments

The project described was supported by award number K99LM009825 from the National Library Of Medicine to Matthew Scotch. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Library Of Medicine or the National Institutes of Health. The authors wish to thank

Dr. Aniruddha Deshpande for use and modification of his online Delphi tool for survey development and the surveillance experts who participated in the Delphi process.

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Table 1

Response Rate by Profession for the Zoonotic Disease Surveillance Survey

	State Public Health Veterinarians (SPHV)	State Veterinarians (SV)	Total	p-value
Number of Surveys Sent	35	44	79	
Number of Responses	25	39	64	
Response Rate	71%	89%	81%	.053

Table 2

Survey results by occupation State Public Health Veterinarians (SPHV) vs. State Veterinarians (SV). Results for Yes/No questions are shown for 'Yes' responses. The table shows the 17 questions from the survey not including the question 'What is your occupation?' from Table 1.

Surveillance Category	Survey Item	SPHV %(N)	SV % (N)	p-value
<u>Data Management</u>				
	1. At your agency, is reportable data for zoonotic diseases of animals or humans stored electronically? (YES/NO)	100 % (25/25)	62 % (24/39)	<.001*
	<u>If YES</u>			
	2. Which reportable disease data is stored electronically?			
	▪ Clinical data from a hospital or clinic of Human medicine?	80 % (20/25)	3% (1/39)	<.001*
	▪ Clinical data from a hospital or clinic of Animal medicine	20 % (5/25)	18 % (7/39)	1.0
	▪ Laboratory data about a diagnostic test on a human	92 % (23/25)	3% (1/39)	<.001*
	▪ Laboratory data about a diagnostic test on an animal	52 % (13/25)	59% (23/39)	.583
	3. Which software is used to store this data at your agency? @			
	▪ MS Excel	28% (7/25)	28% (11/39)	.986
	▪ MS Access	28% (7/25)	13% (5/39)	.190
	▪ Oracle Database	16% (4/25)	21% (8/39)	.751
	▪ SQL Server Database	8% (2/25)	15% (6/39)	.466
	▪ Notepad or similar text editor	0% (0/25)	0% (0/39)	1.0
	▪ FileMaker	4% (1/25)	5% (2/39)	1.0
	▪ Web Program	40% (10/25)	10% (4/39)	.005*
	▪ Other	44% (11/25)	10% (4/39)	.002*
	4. I, or someone at my agency, can easily retrieve the reportable zoonotic disease data of animals or humans that is stored electronically.	5.63 (avg.)	5.02 (avg.)	.146
	1 = Strongly Disagree			
	4 = Neutral			
	7 = Strongly Agree			
<u>Data Analysis</u>				
	5. At your agency, is reportable data for zoonotic diseases of animals or humans analyzed electronically in any fashion (for outbreak detection, routine summarization, etc.)? (YES/NO)	78 % (18/23)	37 % (14/38)	.002#
	6. Which software is used for statistical analysis of zoonotic data?			
	▪ MS Excel	52% (13/25)	23% (9/39)	.017*
	▪ SAS	36% (9/25)	0% (0/39)	<.001#
	▪ SPSS	8% (2/25)	5% (2/39)	.640
	▪ Stata	0% (0/25)	0% (0/39)	1.0
	▪ EpiInfo	48% (12/25)	0% (0/39)	<.001#
	▪ Other	16% (4/25)	10% (4/39)	.701
	7. At your agency, the current method of statistically analyzing (for any public health purpose) reportable data for zoonotic diseases of animals or humans is sufficient.	4.74 (avg.)	3.36 (avg.)	0.04†
	1 = Strongly Disagree			

Surveillance Category	Survey Item	SPHV %(N)	SV % (N)	p-value
Collaboration	4 =Neutral			
	7 = Strongly Agree			
	8. How does your agency share zoonotic disease data with Agriculture Departments? [^]			
	▪ Phone	80 % (20/25)	82 % (32/39)	1.0
	▪ Email	80 % (20/25)	92 % (36/39)	.245
	▪ Fax	36 % (9/25)	44 % (17/39)	.546
	▪ Alert Network (e.g. HAN)	16 % (4/25)	13 % (5/39)	.728
	▪ Automated Electronic Data Transfer	4 % (1/25)	8 % (3/39)	1.0
	9. How does your agency share zoonotic disease data with Health Departments? [^]			
	▪ Phone	84% (21/25)	85% (33/39)	1.0
	▪ Email	72% (18/25)	92% (36/39)	.039 [#]
	▪ Fax	64% (16/25)	44% (17/39)	.111
	▪ Alert Network (e.g. HAN)	20% (5/25)	10% (4/39)	.296
	▪ Automated Electronic Data Transfer	12% (3/25)	3% (1/39)	.291
	10. How does your agency share zoonotic disease data with Wildlife Departments? [^]			
Improving Surveillance	▪ Phone	72% (18/25)	90% (35/39)	.092
	▪ Email	72% (18/25)	90% (35/39)	.092
	▪ Fax	40% (10/25)	44% (17/39)	.777
	▪ Alert Network (e.g. HAN)	4% (1/25)	3% (1/39)	1.0
	▪ Automated Electronic Data Transfer	0% (0/25)	3% (1/39)	1.0
	11. Zoonotic surveillance data from other agencies such as Agriculture, Wildlife, or Health Departments are important for surveillance at your agency? (YES/NO)	91 % (20/22)	100 % (38/38)	.131
	12. Is there zoonotic surveillance data that is too sensitive to share with other agencies such as Agriculture, Wildlife, or Health Departments? (YES/NO)	57 % (13/23)	41 % (15/37)	.228
	13. Geographical Information Systems (GIS) for analyzing disease distribution over geographic areas (zip codes, counties, etc.) are important for zoonotic surveillance.	5.72 (avg.)	6.41 (avg.)	.024 [†]
	1 = Strongly Disagree			
	4 = Neutral			
	7 =Strongly Agree			
	14. Computer systems that automatically retrieve clinical data of humans from hospital Electronic Medical Records (EMR) systems are important for improving the timely receipt of zoonotic case data.	5.67 (avg.)	5.33 (avg.)	.395
	1 = Strongly Disagree			
	4 = Neutral			
	7 = Strongly Agree			
	15. Computer systems that automatically retrieve clinical data of animals from animal hospital Electronic Medical Records (EMR) systems are important for improving the timely receipt of zoonotic case data.	4.89 (avg.)	5.1 (avg.)	.676

Surveillance Category	Survey Item	SPHV %(N)	SV % (N)	p-value
	1 = Strongly Disagree			
	4 = Neutral			
	7 = Strongly Agree			
	16. Computer systems that automatically retrieve clinical data of humans from hospital Electronic Medical Records (EMR) systems are important for improving the completeness of zoonotic case data.	5.76 (avg.)	5.17 (avg.)	.086
	1 = Strongly Disagree			
	4 = Neutral			
	7 = Strongly Agree			
	17. Computer systems that automatically retrieve clinical data of animals from animal hospital Electronic Medical Records (EMR) systems are important for improving the completeness of zoonotic case data.	4.52 (avg.)	4.65 (avg.)	.730
	1 = Strongly Disagree			
	4 = Neutral			
	7 = Strongly Agree			

* Significant at the 0.05 level using Chi-Square test.

Significant at the 0.05 level using Fisher's Exact test.

† Significant at the 0.05 level using Mann-Whitney U test.

^ Additional category 'Other' not shown.

@ Question adapted from (Burke & Evans, 2003). Wording of questions slightly modified from original version due to formatting.