Master of Public Health

Applied Practice Experience

by

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MPH Candidate

submitted in partial fulfillment of the requirements for the degree

MASTER OF PUBLIC HEALTH

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Chapter 1 - Portfolio Products

I completed my Applied Practice Experience (APE) at the California Department of Public Health (CDPH) under the supervision of Gail Sondermeyer-Cooksey, MPH. My work was conducted in collaboration with graduate students at the University of California-Berkeley School of Public Health. The CDPH conducts surveillance, investigation, control, and prevention of important infectious diseases in California, and consists of 4 sections: Disease Investigations (DIS), Vector-Borne Disease (VBDS), Veterinary Public Health (VPHS), and Surveillance and Statistics (SSS). Coccidioidomycosis is one of the most common infectious diseases reported to the agency (https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/SSS.aspx). Gail Cooksey has been with the Branch since 2012 and has an MPH from the University of California, Berkeley with an emphasis on infectious diseases and vaccinology.

Products completed were:

1) A master datasheet containing national dog serologic test data from the last ten years (2012 to 2023) from all major laboratories performing serologic testing for coccidioidomycosis in the United States. The raw collated data included over two million test results. These were reduced to 887,764 individual dog test results after data clean-up to remove serially tested dogs, non-dog test results, and results with no associated temporal or spatial information;
2) A suite of over 40 ArcGIS Pro-generated maps (that depict the change in spatial distribution of US-wide domestic dog serologic test results between 2012 and 2023 and identify hot and cold spots for further studies;
3) Incidence curves that compare the incidence of positive serologic test results in dogs from Arizona and California to that in humans over the 10-year study period;
4) A one-hour oral presentation given to the Remais-Barker collaborative research group meeting on the background and results of preliminary data analysis (July 11, 2023);
5) A 30-minute oral presentation given to industry (Anivive Life Sciences) and researchers at the University of Arizona Center for Valley Fever on the relevance of my work and preliminary data to preventative measures, including vaccination strategies (August 21, 2023);
6) A 30-minute oral presentation given to leadership of the American Veterinary Medical Association (AVMA) and data scientists who compile and analyze pet ownership data for the association (August 28, 2023);

7) An abstract that was submitted to the American Public Health Association for their epidemiology late-breaking call. Although not accepted for that call, the abstract will be updated and submitted for a conference in early 2024 (either the 2024 Keystone Symposia on Fungal Pathogens or the 2024 Coccidioidomycosis Study Group Meeting).

Table 1.1 Summary of Portfolio Products

Portfolio Product		**Description**
1	Master datasheet	Excel and CSV files with signalment, temporal, and spatial information for all dogs tested for antibodies to *Coccidioides* between January 2012 and August 2023 (over 800,000 individual dog test results after data clean up). For all laboratories, temporal information was recorded to the exact date of testing (dd/mm/yyyy) and spatial information was available to the county level. For some laboratories, spatial information was available to the practice or owner zip code level.
2	ArcGIS Pro maps	30+ maps generated using ArcGIS Pro that illustrate the county-level spatial distribution of a) total serologic tests performed; 2) prevalence of seroreactivity; and 3) incidence of positive test results (per 10,000 households) for each year from 2012 to 2023. Counties in which total test numbers were low (< 10 tests) are overlaid on incidence and prevalence maps in order to separate travel-related cases and false positive results in low-prevalence regions from regions of emerging endemicity.
3	Incidence curves	Incidence curves that compare the annual incidence of positive test results over time

		in dogs with that in humans to determine whether there is an association between the temporal pattern of coccidioidomycosis in dogs and that in humans.
4	Powerpoint presentations	Presentations developed for the Remais-Barker group collaboration call and Anivive LifeSciences to inform them of preliminary data results and how that might influence a) future strategies to understand how climate change might be impacting the epidemiology of Valley Fever in humans, and 2) prevention strategies such as vaccination.
5	Abstract	Written abstract for submission to a conference focused on public health, environmental health, or mycology.

Table 1.2 Portfolio Products and Competency Addressed

Portfolio Product		Number and Competency Addressed	
1	Master datasheet	2, 21	Select quantitative and qualitative data collection methods appropriate for a given public health context; Perform effectively on interprofessional teams
2	ArcGIS Pro maps	3,4, 21	Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate; Interpret results of data analysis for public health research, policy or practice; Perform effectively on interprofessional teams
3	Incidence curves	3,4, 21	Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and

			software, as appropriate; Interpret results of data analysis for public health research, policy or practice; Perform effectively on interprofessional teams
4	Powerpoint presentations	19, 21	Communicate audience-appropriate public health content, both in writing and through oral presentation; Perform effectively on interprofessional teams
5	Abstract	19, 21	Communicate audience-appropriate public health content, both in writing and through oral presentation; Perform effectively on interprofessional teams

Chapter 2 - Competencies

Table 2.1 Summary of MPH Foundational Competencies

Number and Competency		Description
2	Select quantitative and qualitative data collection methods appropriate for a given public health context	Gathered quantitative and qualitative serologic data over a 10-year period with sufficient spatial and seasonal granularity to identify how dog serologic test results might inform public health decision-making
3	Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate	Used Excel and GIS software (ArcGIS Pro) to perform descriptive statistics and map spatial distribution of Coccidioides distribution in dogs. Use statistical modeling to understand spatial and temporal distribution of *Coccidioides* exposure in dogs and compare these to what has been reported in humans
4	Interpret results of data analysis for public health research, policy or practice	Results of the above analyses were interpreted in light of previous studies on predictions of the spread of coccidioidomycosis and proposed mitigation strategies. Conclusions were made regarding how the results could influence future modelling strategies, public health policy (reporting procedures), and public health practice (increased awareness/education, environmental controls and PPE, vaccination)

19	Communicate audience-appropriate public health content, both in writing and through oral presentation	Wrote abstract and delivered oral presentation to communicate study findings and implications to public health professionals, academics, and industry members
21	Interprofessional and/or intersectional practice: integrate perspectives from other sectors and/or professionals to promote and advance population health	Engaged a multidisciplinary collaborative team that included epidemiologists, veterinarians, physicians, public health professionals, statisticians, geographers, and laboratory diagnosticians in order to gather and analyze data using state-of-the-art technology to gain improved understanding of an important emerging public health problem.

Detailed Explanation of Each Competency and How It Was Addressed During the APE

Competency 2. Select quantitative and qualitative data collection methods appropriate for a given public health context.

The goals of this competency are to identify the most appropriate sources and types of data in order to prove or disprove the public health research hypotheses of interest. The most relevant courses were Biostatistics (MPH/STAT 701), Epidemiology (MPH/DMP 754), Health Services Administration (MPH/HMD 720), and GIS I (GEOG 508); but knowledge gained from Environmental Health Sciences (MPH/DMP 802) and One Health (DMP 710) also had relevance.

I hypothesized that serosurveillance efforts for coccidioidomycosis in dogs would provide valuable insight into the epidemiology of coccidioidomycosis in humans, and would help to inform implementation of risk intervention strategies (e.g., dust exposure mitigation, increased awareness and early testing, and vaccination), and more specifically that:

a) the spatial distribution of canine serologic test data would correlate with that reported for humans (in regions where reporting of human cases occurs) and, in regions where no human data exist, would aid in identification of emerging regions of endemicity
b) Inter-annual and seasonal patterns of seroreactivity in dogs would correlate with those reported for humans in California and Arizona, and would validate the dog as a sentinel for prediction of human exposure and disease

Qualitative data collection methods selected to identify the most appropriate types of data to address these hypotheses were:

a) Interviews with laboratory directors who perform canine testing for coccidioidomycosis to identify all major laboratories that perform such testing in the United States and to gather information including:
    a. methods of testing performed (agar gel immunodiffusion, enzyme immunoassay, complement fixation, PCR)
    b. data collected from tested animals (e.g., date, zip code, county, age, breed, sex)
    c. data archives (how many years, what system, what data can be retrieved, what data can be shared, formatting)
b) Interviews with public health officials at the CDPH regarding collection and availability of human reporting data for comparison purposes
c) Availability of denominator (population) data for incidence calculations
d) Identification and examination of publicly available statistical data on coccidioidomycosis in humans from the Centers for Disease Control and Prevention (CDC)
e) Identification of existing materials for education of the public on the risks of coccidioidomycosis and mitigation practices (including occupational risks and recommendations for risk mitigation)
f) Case study research on dogs as sentinels for emerging regions of human coccidioidomycosis (e.g., Washington state)
g) Obtaining information on optimal geospatial and statistical approaches for data analysis through online research, class notes, and meetings with instructors and collaborators.

This APE was strongly focused on quantitative data collection methods. To test my hypotheses, I gathered both categorical (e.g., positive/negative, county, laboratory, date) and numeric (e.g., dog age, body weight, antibody titer) data for individual dogs tested for serum antibodies to *Coccidioides* spp. by all major laboratories that perform testing in the United States.

Competency 3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming, and software, as appropriate.

Biostatistics refers to use of statistics to analyze biological data; according to the American Medical Informatics Association, informatics is "the use of science to use data, information, and knowledge to improve human health and the delivery of health care services." Thus, this competency requires familiarity with software platforms such as Microsoft Excel, R Studio, Prism, and ArcGIS Pro; the steps required to perform appropriate data transformations; knowledge regarding which statistical tests should be used to query available data; and how those tests are performed. During my APE, I developed skills in the use of multiple software platforms used for biostatistics, which were used to clean (Microsoft Excel, R Studio), transform (Microsoft Excel, R Studio, ArcGIS Pro), and analyze (Microsoft Excel, R Studio, Prism, ArcGIS Pro) the data I collected from laboratories participating in the study. I learned how programming through R Studio could be used to rapidly extract and organize a large amount of data. I then used Excel to query and quantify these data and prepare data for spatial analysis using ArcGIS Pro; ArcGIS Pro was used to map the spatial distribution of canine *Coccidioides* cases for each year of the study and perform hot spot analyses to identify the locations of statistically significant hot spots and cold spots in my data. I also became familiar with sources of relevant data and how that information can be accessed and used for data analysis (e.g., population data from the U.S. Census Bureau, pet ownership data from the American Veterinary Medical Association, climate data from PRISM Climate Group). I also learned how platforms such as R studio and GraphPad Prism could be used to perform statistical analysis of incidence data, such as determining the strength of correlations between human and canine incidence data. The most relevant courses for this competency were Biostatistics (MPH/STAT 701), Epidemiology (MPH/DMP 754), GIS I (GEOG 508), and Health Services Administration (MPH/HMD 720).

Competency 4. Interpret results of data analysis for public health research, policy, or practice

This competency requires an understanding of the significance of the output of data analysis performed using the software platforms described above (Competency 3), and how the results obtained could be used to make decisions or create policies that improve public health and inform additional research studies. It also required an understanding of fundamental concepts

of epidemiology such as incidence, prevalence, and predictive value. Relevant courses were Biostatistics (MPH/STAT 701) and Epidemiology (MPH/DMP 754), but also Environmental Health Sciences (MPH/DMP 802), One Health (DMP 710), Health Services Administration (MPH/HMD 720), GIS I (GEOG 508), and Social and Behavioral Sciences (MPH/KIN 818).

In this study, incidence maps created for each year of canine serologic data collection were analyzed to identify counties where *Coccidioides* spp. are likely endemic and whether the spatial distribution of *Coccidioides* spp. has increased over the last decade. I identified sources of bias that could affect the validity of my results and considered ways that I could reduce the effects of such bias (such as differences in dog ownership among counties and over time and the impact of dog travel on the results). I then considered how the results could influence 1) future modelling strategies to predict the spread of Valley fever with climate change, 2) public health policy (such as mandatory reporting of human cases in some states where reporting currently does not exist), and 3) public health practices that might reduce the incidence of Valley fever (such as increased awareness/education of those at risk, recommendations for use of particulate respirators by construction and agricultural workers in regions of endemicity, and ultimately, the need for targeted vaccination of those at risk)

Competency 19. Communicate audience-appropriate public health content, both in writing and through oral presentation.

Audience-appropriate public health content is content that is relevant to specific groups of people that might be impacted by a public health problem, such as construction or agricultural workers that work in regions where *Coccidioides* spp. is endemic, or specific racial groups that are predisposed to more severe disease. Written materials could be abstracts, scientific papers, website content, flyers or handouts, op-eds, book chapters, posters, etc. Oral presentations could be delivered at conferences, through webinars (live or recorded), or at information sessions organized for specific audiences that might be impacted by a public health problem. Written materials for specific audiences that I developed during my APE were an abstract for a scientific conference, and my integrated learning experience (ILE) report; I am also working on a scientific publication. I have delivered three oral presentations. The first was delivered to a research coalition between two laboratories that work on the epidemiology of Valley fever in California (Remais laboratory at the University of California-Davis) and state public health officials from California and Arizona. The second was delivered to the scientific advisory board

of Anivive Life Sciences, an industry group that is developing a vaccine for Valley fever for both dogs and humans. The third presentation was delivered to AVMA leadership and the data scientists employed by the AVMA, for the purposes of determining how dog ownership data collected by the AVMA could be incorporated into future analyses to better understand the epidemiology of Valley fever and more accurately identify emerging regions of endemicity than we can identify using U.S. Census Bureau human population data (number of households/county). Each presentation was tailored to the specific interests of the audience, focusing on how the findings might have relevance to the attendees and ultimately how attendees could use the findings to positively impact public health outcomes. The most relevant course was Multidisciplinary Thought and Writing (DMP 815), but a variety of other courses had relevance, including Epidemiology (MPH/DMP 754), Environmental Health Sciences (MPH/DMP 802), One Health (DMP 710), GIS I (GEOG 508), Social and Behavioral Sciences (MPH/KIN 818).

Competency 21. Interprofessional and/or intersectional practice: integrate perspectives from other sectors and/or professionals to promote and advance population health.

Relevant courses for this competency were Health Services Administration (MPH/HMD 720), Social and Behavioral Sciences (MPH/KIN 818), and Multidisciplinary Thought and Writing (DMP 815). Performing effectively on interprofessional teams requires identification of clear goals, listening to others, creating a culture of respect, understanding the strengths of individual team members and how they might help to achieve the goals of interest, time management skills, and clear and concise communications that are delivered in a timely fashion. A clear leader should also be identified who listens, guides decision-making, and acts in a timely and appropriate manner. These and other characteristics of a good interdisciplinary team were described in a 2013 study by Nancarrow et al.[1]

During my APE, I engaged a multidisciplinary collaborative team that included epidemiologists, veterinarians, physicians, public health professionals, statisticians, geographers, and laboratory diagnosticians in order to gather and analyze data using state-of-the-art technology to better understand an important emerging public health problem. The team consisted of collaborators from the California Department of Public Health, the University of California-Berkeley, laboratory directors and staff members from seven different diagnostic laboratories, Kansas State University Department of Geography and Geospatial Sciences (Helene Avocat), and the

AVMA. I worked to understand the interests of the different individuals and communicate the goals of the study; and how their knowledge, information, and skills could be harnessed for the benefit of public health. I organized many zoom and in-person meetings, responded in a timely fashion to their communications, analyzed and signed data use agreements, and provided feedback on how resources they provided resulted in meaningful outcomes. I also worked to ensure that team members were appropriate recognized for their contributions.

1. Nancarrow SA, Booth A, Ariss S, et al. Ten principles of good interdisciplinary team work. Hum Resour Health 2013;11:19.

Table 2.2 MPH Foundational Competencies Course Mapping

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
Evidence-based Approaches to Public Health					
1. Apply epidemiological methods to the breadth of settings and situations in public health practice	x		x		
2. Select quantitative and qualitative data collection methods appropriate for a given public health context	x	x	x		
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate	x	x	x		
4. Interpret results of data analysis for public health research, policy or practice	x		x		

Public Health and Health Care Systems					
5. Compare the organization, structure and function of health care, public health and regulatory systems across national and international settings		x			
6. Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels					x
Planning and Management to Promote Health					
7. Assess population needs, assets and capacities that affect communities' health		x		x	
8. Apply awareness of cultural values and practices to the design or implementation of public health policies or programs					x
9. Design a population-based policy, program, project or intervention			x		
10. Explain basic principles and tools of budget and resource management		x	x		
11. Select methods to evaluate public health programs	x	x	x		
Policy in Public Health					
12. Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence		x	x	x	
13. Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes		x		x	x
14. Advocate for political, social or economic policies and programs that will improve health in diverse populations		x			x
15. Evaluate policies for their impact on public health and health equity		x		x	
Leadership					
16. Apply principles of leadership, governance and management, which include creating a vision, empowering others, fostering collaboration and guiding decision making		x			x
17. Apply negotiation and mediation skills to address organizational or community challenges		x			
Communication					
18. Select communication strategies for different audiences and sectors	DMP 815, FNDH 880 or KIN 796				
19. Communicate audience-appropriate public health content, both in writing and through oral presentation	DMP 815, FNDH 880 or KIN 796				
20. Describe the importance of cultural competence in communicating public health content		x			x
Interprofessional Practice					
21. Perform effectively on interprofessional teams		x			x
Systems Thinking					
22. Apply systems thinking tools to a public health issue			x	x	