
BODY OF KNOWLEDGE FOR HEALTH ADMINISTRATION EDUCATION: TEACHING EPIDEMIOLOGY IN THE AGE OF HEALTH CARE REFORM

ROSEMARY M. CARON, PhD, MPH, EDMOND A. HOOKER, MD,
DRPH, & JESSICA D. ULRICH-SCHAD, MA

ABSTRACT

As we embark on reforming the U.S. healthcare system, population-based healthcare is becoming even more important, and epidemiology is the basic science we will use to evaluate our effectiveness. Although recent research has shown that most undergraduate and graduate programs in health administration teach epidemiology courses in their curricula, the goals, objectives, and final content for such a course remain inconsistent across the programs. There are limited guiding principles (e.g., accreditation and certification criteria) on what health administration programs should expect of students studying epidemiology. To assess the similarities and differences in epidemiological content taught at the undergraduate and graduate levels, we systematically reviewed epidemiology content by querying those who teach this specific course via a national survey tool and syllabi obtained from programs. The purpose of this paper is to describe, for health administration programs, the (a) body of knowledge (i.e., content, principles) for a course in epidemiology taught at the undergraduate and graduate levels; and (b) perspectives of instructors regarding their approach in teaching epidemiology at the undergraduate or graduate level. This work will serve as a guide that can help educators when developing the competencies, goals, and objectives for epidemiology courses in their health administration programs.

Keywords: Epidemiology, healthcare administration education, healthcare reform, body of knowledge, public health

Please address correspondence to: Rosemary M. Caron, PhD, MPH, Associate Professor, Department of Health Management and Policy, College of Health and Human Services, University of New Hampshire, #319 Hewitt Hall, 4 Library Way, Durham, New Hampshire 03824, Phone: (603) 862-3653, Email: Rosemary.Caron@unh.edu.

Acknowledgement: We are grateful for the participation of program directors of AUPHA-certified undergraduate and CAHME-accredited graduate health administration programs; the instructors of undergraduate and graduate epidemiology courses; and the Public Health Faculty Forum members who contributed to the discussion of this research question at the 2012 annual AUPHA meeting. In addition, we are grateful to the reviewers for their insightful comments that contributed to strengthening the communication of this work.

“Epidemiology is considered by many to be a critical branch of public health. In fact, it is often referred to as the basic science of public health” (Fos, 2011). Friis and Sellers (2009) describe epidemiology as a “...discipline that describes, quantifies, and postulates causal mechanisms for health phenomena in populations.” The public health practitioner uses the results of epidemiologic studies to prevent disease and promote health of a population. Gorsky (1989) argues that the healthcare administrator should utilize this science of public health to not only identify the healthcare needs of a population, but also to determine the feasibility in providing the healthcare services necessary to address those identified needs. Thus, epidemiology is a discipline that is diverse in its application to both assessing the health of the community and the effectiveness of the healthcare system.

As we embark on reforming the U.S. healthcare system, population-based healthcare is becoming even more important, and epidemiology is the basic science we will use to evaluate the effectiveness of this revised system (i.e., are we able to improve population health while containing costs?) (Caron, 2010). Caron (2010) proposes that managerial epidemiology – the branch of epidemiology that integrates the business aspect of healthcare (i.e., demand, delivery, resource allocation, planning, quality, and managed care) with the core functions (i.e., assessment, policy development, and assurance) of public health - should be the evaluation tool to determine our effectiveness in providing quality care, reducing costs, and lowering the demand for the millions of additional people in a new healthcare system. Filerman (1982) created the term “managerial epidemiology” and has provided selected examples of healthcare management decisions that require the utility of the skills provided by this science of public health. For example:

- “Deciding whether to initiate a preventive program aimed at a particular problem. Determining the range of services to be included. Evaluating the use and efficacy of the program.”
- “Evaluating alternative delivery modes, such as satellite practice groups, ambulatory surgical centers, emergency posts, and day surgery. Identifying alternative investment options, estimating use, and evaluating impact.”
- “Identifying the etiology of diseases resulting from exposures incidental to contact with the health services system. Evaluating steps to alleviate iatrogenic disease.”

The Association for University Programs in Health Administration (AU-PHA) has previously identified managerial epidemiology as the “scientific basis for any health system reform” (Roper et al., 1993). Are we educating

students in healthcare administration programs to be able to use this science to address the effectiveness of their healthcare organizations in a reformed system, whether it is a local community health center or a multistate healthcare corporation? The field of public health has examined this question for current and future public health professionals working in public health agencies. For example, “The Association of Schools of Public Health [ASPH] has developed a set of academic core competencies that it recommends that all Master of Public Health (MPH) students should possess prior to graduation” (Moser et al., 2008). Also, “In 2004, CDC [Centers for Disease Control and Prevention] and CSTE [Council of State and Territorial Epidemiologists] convened an expert panel to define Competencies for Applied Epidemiologists in Governmental Public Health Agencies (AECs), with the goal to improve the practice of epidemiology in public health agencies” (Moehrle, 2008). Furthermore, the Council on Education in Public Health (CEPH) accredits schools and programs offering public health degrees based on criteria for standards, outcomes, and quality of educational curricula and other degree program components (CEPH, 2013). These professional organizations worked to develop a competency-based accreditation system for public health graduate education and practice.

In addition to competency development for public health and epidemiology, in particular, other areas of the health management curriculum have begun to create a body of knowledge for specific content areas, such as health information technology (HIMSS, 2013). Desired skill sets and knowledge areas have also been developed for the practitioner in the field. For example, the Council on Linkages Between Academia and Public Health Practice has developed core competencies for public health professionals entering the workforce at an entry level, for supervisors and managers, senior managers, and Chief Executive Officers (Council, 2013). These competencies are a set of skills that reflect the practice of public health in diverse settings. In addition, the American College of Medical Practice Executives, the standard-setting and certification body of the Medical Group Management Association, has also released a document that outlines the body of knowledge required for medical practice management (ACPME, 2011). Specifically, this document “defines the unique knowledge and skill set for the medical practice management executive” (ACPME, 2011).

Graduate programs in health administration education are also influenced by standards. The Commission on Accreditation of Health Management Education (CAHME) is the accrediting body for graduate programs in health administration education. CAHME currently utilizes a competency-based

outcomes assessment for its accredited programs. This is a new development for this accrediting body, as it previously directed specific course content that should be covered in the graduate health administration curricula (CAHME, 2013). At the undergraduate level, AUPHA is the professional certifying organization for undergraduate programs in health administration education (AUPHA, 2013). Both CAHME and AUPHA have acknowledged the important role epidemiology plays in healthcare administration. As a result, population health and status assessment are required components of health administration education (AUPHA, 2013; CAHME, 2013). However, in response to CAHME's newly instituted competency-based outcomes assessment approach for its accreditation process, as opposed to the prior content-driven method, AUPHA addressed this new gap by establishing a Body of Knowledge initiative that sought to "...delineate the content that students in health management programs should learn during the course of their study. The Body of Knowledge differs from competencies in that it refers to the knowledge base, or content, rather than the student's ability to demonstrate skill in use of the content. It assumes that competency in application requires a basic knowledge of facts, theories, and analytical approaches" (Middleton, 2012). The Chairs of each AUPHA Faculty Forum, an online community for AUPHA members to discuss issues and share resources pertaining to their expertise in health administration education, were requested to respond to AUPHA's call to action to develop a body of knowledge for their area of expertise. Hence, the purpose of the research described herein was to identify, for health administration programs, the (a) body of knowledge (i.e., content and principles) specific for a course in epidemiology taught at the undergraduate and graduate levels; and (b) perspectives of instructors regarding their approach to teaching epidemiology at the undergraduate or graduate level. This work will fill a gap in the literature by serving as a guide that can help educators when developing the competencies, goals, and objectives that are based on generalized content areas for epidemiology courses in their specific health administration programs.

METHODS

Cross-Sectional Survey Sample and Design: The Department of Health Management and Policy and the Department of Sociology at the University of New Hampshire, in collaboration with the Department of Health Services Administration at Xavier University, developed and conducted a formal, descriptive, cross-sectional survey of all AUPHA (undergraduate) and CAHME (graduate) university-based member institutions. Specifically, the directors of both the undergraduate programs ($n = 47$) and graduate programs ($n = 69$) were identified via the AUPHA and CAHME online directories and were contacted via

e-mail or phone for the contact information of the primary faculty member who taught an epidemiology course in their program. Epidemiology instructors were then contacted via e-mail or phone for their input about what concepts and principles should constitute a body of knowledge for epidemiology. In addition, an invitation to participate in this research was posted on the Public Health Faculty Forum.

Based on an extensive literature review of epidemiology in health administration curricula at the undergraduate and graduate levels (Thompson, 1978; Fos et al., 1998; Dever, 2006; Fleming, 2008; Hooker, 2008; Caron & Hooker, 2011), one open-ended survey question was developed regarding the instruction of epidemiology in the respective program's department: "For each type of student population, undergraduate and graduate students, please describe, in your opinion and experience, what is the epidemiologic body of knowledge (i.e., content and principles) that such a student should possess at the completion of the course." The survey question was reviewed and approved by AUPHA leadership. Respondents were also encouraged to submit a copy of their course syllabus electronically.

Program directors of all AUPHA-certified undergraduate health administration programs (47 total) were either e-mailed and/or telephoned and 21 epidemiology instructors from these respective programs responded via e-mail, phone, or provided their course syllabus electronically. Six of the 47 undergraduate programs disclosed that they have no history of teaching epidemiology in their curriculum, are not currently teaching epidemiology, or they bring in external adjunct faculty to teach their epidemiology course. The response rate for epidemiology instructors of AUPHA-certified undergraduate health administration programs was 51% (21/41). All directors of CAHME-accredited graduate health administration programs (69 total) were also either e-mailed and/or telephoned. Twenty-eight epidemiology instructors from these respective programs responded via e-mail, phone, or provided their course syllabus electronically. Eight of the 69 graduate programs disclosed that they are not currently teaching epidemiology in their curriculum. The response rate for epidemiology instructors of CAHME-accredited graduate health administration programs was 46% (28/61). Epidemiology instructors from undergraduate and graduate health administration programs from across the United States participated in the survey.

The study was approved by the Institutional Review Boards at the University of New Hampshire and Xavier University, respectively.

Sampling Methodology: An electronic database of program directors at the undergraduate and graduate level was created utilizing the listing of undergraduate-level AUPHA certified member programs on the AUPHA website

(AUPHA, 2010) and the online CAHME Directory of Programs (CAHME, 2012). The invitation letter to participate in the survey was e-mailed to each program director of AUPHA and CAHME member programs. In addition, we telephoned those who did not respond by e-mail. Once contact was made with the program director, the contact information for the individual responsible for teaching the program's epidemiology course was requested. E-mails were sent to the program directors requesting their epidemiology instructor's contact information every other week for six weeks; and epidemiology instructors were reminded to respond to the survey every other week for six weeks; a total of three reminders were e-mailed during the study period. Once the program director provided their program's epidemiology instructor contact information or the epidemiology instructor completed the survey via email or telephone, an e-mail thanking the respondent for their participation was sent. The survey question took the epidemiology instructors 10-15 minutes to complete. In addition, the Public Health Faculty Forum of the AUPHA Network was utilized twice to serve as a reminder tool for program directors and epidemiology instructors to participate in this research project. Furthermore, additional input on this research question was received during the Public Health Faculty Forum's member meeting at the 2012 AUPHA annual meeting in Minneapolis, MN. The Chair and former Chair of the Public Health Faculty Network jointly facilitated the Public Health Faculty Forum member meeting and recorded the meeting minutes of the 24 attendees.

Data Analysis: Qualitative analysis was used to evaluate the responses to the open-ended question regarding the body of knowledge for epidemiology in an undergraduate and/or graduate course. The three authors of the manuscript coded the text from the responses into content themes. Nueundorf (2002) defines content analysis "as the systematic, objective, quantitative analysis of message characteristics." We identified the thematic categories through discussion to reach a consensus.

Fifteen syllabi (seven from undergraduate and eight from graduate programs) were received electronically from epidemiology instructors who were contacted. The teaching method implemented, textbook utilized, and learning assessments assigned by each epidemiology instructor were noted.

We specifically tested the following hypothesis: the body of knowledge for epidemiology in undergraduate and graduate programs in health administration education will differ in content and teaching approach.

RESULTS

The content analysis for the epidemiological body of knowledge taught in undergraduate and graduate health administration programs revealed overlapping themes; however, the data for undergraduate epidemiology courses highlighted a body of knowledge more cognitive in nature versus a body of knowledge that is more applied in nature for graduate epidemiology courses. The content analysis for the epidemiological body of knowledge taught in undergraduate health administration programs identified eight key themes:

1. Historical epidemiology
2. Definitions of epidemiological terms used to describe health
 - a. Incidence, prevalence, risk, morbidity, mortality
 - b. Epidemic, endemic, outbreak
3. Social Determinants of Health
4. Measurement
 - a. Frequency
 - b. Effect
 - c. Odds ratio and relative risk
 - d. Disease patterns- health disparities
 - e. Surveillance
 - f. Screening
5. Causation
 - a. Sir Bradford Hill Criteria (concepts of causality; Friis & Sellers, 2009)
6. Study design
 - a. Descriptive epidemiology
 - b. Analytical epidemiology
 - c. Threats to validity (chance, bias, confounding)
7. Data
 - a. Sources of data
 - i. Strengths and weaknesses of public available data
 - ii. Risk
 - b. Ethics
 - i. Institutional Review Board
8. Practical Applications of epidemiology
 - a. Health Literacy

These themes align with the curriculum framework for undergraduate epidemiology jointly proposed by the Association for Prevention, Teaching and Research and the Association of American Colleges and Universities (Riegelman & Albertine, 2008). This framework is one of three implementation recommendations for undergraduate public health education that originated from the Institute of Medicine's proposal that "all undergraduates should have access to education in public health" (IOM, 2003). The epidemiology framework proposes that an undergraduate should know the historical contributions and modern uses of epidemiology to be able to see the value of epidemiology from a historical perspective, as well as understand the patterns of disease occurrence and how we measure their distribution and frequency to help determine causation. In addition, this framework also emphasizes the need to be aware of social, economic, ethical, environmental, cultural, and political factors (i.e., social determinants of health) that should be considered when developing interventions. Additional components of this national framework include: understanding the basic tools of epidemiology, including the significance and sources of public health data, study designs and their applications; evidence-based public health practice; and the application of epidemiology to policy, and the basic and clinical sciences (Riegelman & Albertine, 2008).

The content analysis for the epidemiological body of knowledge taught in graduate health administration programs identified eight key themes:

1. Definitions of epidemiological terms used to describe health
 - a. Incidence, prevalence, risk, morbidity, mortality
 - b. Epidemic, endemic, outbreak
2. Social Determinants of Health
3. Measurement
 - a. Frequency
 - b. Effect
 - c. Odds ratio and relative risk
 - d. Disease patterns- health disparities
 - e. Surveillance
 - f. Screening
 - g. Survey Design
 - h. Geographic Information Systems
4. Causation
 - a. Sir Bradford Hill Criteria (concepts of causality; Friis & Sellers, 2009)

5. Critically Review the literature
 - a. Study Design
 - i. Descriptive epidemiology
 - ii. Analytical epidemiology
 - iii. Threats to validity (chance, bias, confounding)
6. Data
 - a. Sources of data
 - i. Strengths and weaknesses of public available data
 - ii. Risk adjustment
 - b. Ethics
 - i. Institutional Review Board
7. Practical Applications of epidemiology
 - a. Evidence-based Practice
 - b. Health literacy
 - c. Disease investigations
8. Difference between clinical and managerial epidemiology

The themes reported here align with the ASPH competencies for graduate students studying epidemiology (Moser et al., 2008). Although the body of knowledge for epidemiology taught in graduate health administration programs is similar to those reported for undergraduate health administration programs, the content is more applied. That is, graduate students would be expected to have a level of proficiency in terms of skill for the identified themes. For example, a graduate student would be expected to identify key sources of public health data and be aware of their inherent strengths and limitations; calculate basic measures of association and apply the results; control for bias and confounding; comprehend basic ethical principles pertaining to the collection, use and dissemination of epidemiologic data; utilize evidence-based practice; and conduct a disease outbreak investigation (Moser et al., 2008).

Content analysis of respondents' opinions about the body of knowledge for epidemiology identified additional themes regarding the instructor's teaching approach for the undergraduate or graduate epidemiology course they teach. The use of lecture was a primary teaching method reported by undergraduate epidemiology instructors. Assessment methods in undergraduate epidemiology courses were mainly via examinations. Undergraduate epidemiology instructors expressed an interest in moving towards more skill-based exercises. One undergraduate epidemiology instructor reported

having a laboratory component to their course which allowed for practicing skills, such as how to conduct a community health assessment; respond to a fictitious food-borne outbreak investigation; and use evidence-based public health information to prioritize interventions based on available resources. A recurrent theme among graduate epidemiology instructors was the applied nature of their courses (i.e., the fundamental principles of epidemiology are reviewed and the majority of time spent in the course involves practical application of those principles via data-driven, decision-making applications). Although lecture was a teaching method reported on the syllabus for some graduate epidemiology courses, discussion was more prevalent in these courses compared to the undergraduate epidemiology courses.

A few examples of how epidemiology is applied in healthcare administration were identified via course exercises located in syllabi. It is important to note that the practical application of epidemiology to healthcare administration was more evident in syllabi for graduate epidemiology courses compared to undergraduate epidemiology courses. One graduate epidemiology instructor integrates the work of a local health department by having students assigned to teams to work on projects for the health department. Each group works with a preceptor from the local health department to examine a real management or public health issue. Teams work for an entire academic year and their results are often published, and some projects have even had an effect on how the health department practices public health. Another graduate epidemiology instructor demonstrates the practical applications of epidemiology to health services planning, quality improvement, policy and system development, and financial management via proposal development related to the students' current work or desired future role in healthcare. An additional example of the application of epidemiology to healthcare administration is in a graduate epidemiology course where the students utilize a case-based method to apply managerial decision-making skills to an epidemiological-based issue. Lastly, several syllabi for graduate-level epidemiology courses outlined an assignment that engaged the student in critically analyzing epidemiological studies from the primary literature.

During the course of the open-ended survey, epidemiology instructors were asked to identify the textbook they utilize in their undergraduate- or graduate-level epidemiology course. In addition, if syllabi were submitted, the textbook(s) required for the epidemiology course was noted. Table 3 includes the textbooks used in the teaching of epidemiology courses in undergraduate ($n = 8$) and graduate ($n = 16$) health administration programs. Some textbooks are used at both the undergraduate and graduate level and others do not appear to have a sole focus on epidemiology. Instructors were not asked to evaluate

the textbook they utilize in their course. The following textbooks were in use by survey respondents at the time of this study:

- *Epidemiology* by Leon Gordis, Elsevier Publishing, 2008
- *Managerial Epidemiology: Concepts and Cases* by Steven Fleming, Health Administration Press, 2008
- *Epidemiology 101: Essential Public Health Series* by Robert Friis, Jones & Bartlett Publishers, 2009
- *Essentials of the U.S. Health Care System* by Leiyu Shi and Douglas Singh, Jones & Bartlett Publishers, 2012
- *Epidemiology: Concepts and Methods* by William Oleckno, Waveland Press, 2008
- *Epidemiology for Public Health Practice* by Robert Friis and Thomas Sellers, Jones & Bartlett Publishers, 2009
- *Introduction to Public Health* by Mary Jane Schneider, Jones & Bartlett Publishers, 2010
- *An Introduction to Epidemiology* by Thomas Timmreck, Jones & Bartlett Publishers, 2012

DISCUSSION

As today's students in health administration education are studying their craft and preparing to work and lead in a healthcare system that is currently undergoing reform, how will they measure their effectiveness in improving the health of their constituents while reducing the costs of health-related services, regardless of the nature of the healthcare facility in which they work? We argue that epidemiology is one of the primary tools that will enable the healthcare leaders of tomorrow to assess their organization's effectiveness in preventing disease and promoting health while maintaining the fiscal vitality of their business. Epidemiology provides both the content and the skills necessary for our students to monitor the trends of access to certain health services, allocate limited resources, plan for surge capacity, and measure clinical outcomes to name a few essential tasks.

Hooker (2008) confirmed the importance of epidemiology, including guidelines, quality, patient satisfaction, and benchmarking to practicing healthcare managers. If accrediting and certifying bodies generally agree that epidemiology is an important component of the health administration education curriculum, as do practitioners, our work has contributed to this progressive theme by beginning to identify, among instructors of epidemiology at the undergraduate and graduate level in these programs, the core, broad content that a student in health administration education should be exposed

to during their academic journey. We do not propose that the body of knowledge for epidemiology presented herein is a standard for a course syllabus or learning objectives. However, we do suggest that the body of knowledge presented for epidemiology be considered and serve as the foundation from which competencies, objectives, and goals will be developed for one's course.

The current research supports our hypothesis that the body of knowledge for epidemiology in undergraduate and graduate programs in health administration education will differ in content and teaching approach. While there was considerable consensus on epidemiological content between undergraduate and graduate courses, instructors of graduate epidemiology courses reported that their course was very applied in nature. The teaching method primarily implemented at the undergraduate level was lecture, while discussion was more common at the graduate level. The range of textbooks reported being used in epidemiology courses may serve as a useful resource for the epidemiology instructor at both the undergraduate and graduate level and may help to contribute to the richness of content presented in these courses.

The strength of this work is that the content deemed to be essential for today's student in health administration education was developed by a sample of epidemiology faculty currently teaching in health administration. The instructor input into this framework is important as the instructors are experts in the subject matter at hand and also possess familiarity with the practical application of this content in the "real world." As a result of the dynamic landscape of any field of study, the body of knowledge for epidemiology is a "living document" (AUPHA 2012) that Public Health Faculty Members of the AUPHA professional organization will modify and update as they prepare to teach epidemiology in the age of healthcare reform.

It is important to note that the work described herein is limited by non-response bias, as well as the bias that may be introduced based on self-reported information. Also, our findings may not be generalized to other bodies of knowledge in a health administration curriculum since the survey question is directed to the body of knowledge of a specific field (i.e., epidemiology). We anticipate that the knowledge and skills provided by an undergraduate- or graduate-level epidemiology course would be beneficial to a practicing healthcare administrator, but would not necessarily be the same knowledge or skills required of health information technology, financial management, or ethics – all necessary fields with specific bodies of knowledge that the student of healthcare administration must master. To respond to the breadth of knowledge required by today's healthcare administrator, AUPHA has established an initiative to develop a body of knowledge for health management and policy with specific content proposed for fields in this discipline (AUPHA, 2012).

Furthermore, the epidemiology instructors who responded to our survey could have been adjunct faculty members or faculty members not from a healthcare administration program or department, which might bias their view of the significance of epidemiology in healthcare administration education. Despite these limitations, the methodology utilized was appropriate given the exploratory nature of the work and the findings have been appropriately qualified.

In these changing times of healthcare service planning, delivery, and evaluation, and given the increasing emphasis on measurable outcomes, health administration education students who have a solid foundation in epidemiology will be well-prepared to address and solve the healthcare issues of tomorrow. The body of knowledge project initiated by AUPHA is a solid first step in a process to delineate essential educational content and different teaching approaches for epidemiology, at the undergraduate and graduate level. We anticipate that such an effort will contribute to preparing our future healthcare administrators.

ACKNOWLEDGMENT

We are grateful for the participation of program directors of AUPHA-certified undergraduate and CAHME-accredited graduate health administration programs; the instructors of undergraduate and graduate epidemiology courses; and the Public Health Faculty Forum members who contributed to the discussion of this research question at the 2012 annual AUPHA meeting. In addition, we are grateful to the reviewers for their insightful comments that contributed to strengthening the communication of this work.

REFERENCES

- American College of Medical Practice Executives (ACMPE) (2011). *Body of Knowledge for Medical Practice Management* (2nd ed., p. 2).
- Association of University Programs in Health Administration (AUPHA) (2012). *AUPHA Body of Knowledge for Health Management Education*. Retrieved from <https://higherlogicdownload.s3.amazonaws.com/AUPHA/AUPHA%20BoK%20Edited%20122112.pdf?AWSAccessKeyId=AKIAJH5D4I4FWRALBOUA&Expires=13537781&Signature=mj4gOT5KYdB%2BpgCqnXv%2FEzJAZhs%3D>
- Association of University Programs in Health Administration (AUPHA) (2010). *List of Undergraduate-level AUPHA certified member programs. - The Association of University Programs in Health Administration*. Retrieved from <http://www.aupha.org/custom/directory/programs.cfm?corpType=full%20certified&proctype=undergraduate>

- Association of University Programs in Health Administration (2013). *Undergraduate Certification - The Association of University Programs in Health Administration*. Retrieved from <http://www.aupha.org/i4a/pages/Index.cfm?pageID=3519>
- Caron, R. M., & Hooker, E. (2011). Managerial epidemiology in health administration education: Population health in the age of healthcare reform. *Journal of Health Administration Education*, 28(2), 115 - 164.
- Caron, R. M. (2010). Managerial epidemiology is the best evaluation tool for our new healthcare system. *Academic Medicine*, 85(10), 1549.
- Commission on Accreditation of Health Management Education (CAHME) (2013). *Accreditation: At a Glance*. Retrieved from www.cahme.org/AccrditationAtaGlance.html
- Commission on Accreditation of Health Management Education (CAHME) (2011). *CAHME : The Standard of Excellence in Healthcare Management Education Since 1968*. Retrieved from http://www.cahme.org/dbapp2/program_search.php
- Council on Education in Public Health (CEPH) (2013). *Understanding Accreditation | Council on Education for Public Health*. Retrieved from <http://ceph.org/constituents/understanding-accreditation/>
- Council on Linkages Between Academia and Public Health Practice (Council) (2013). *Core Competencies for Public Health Professionals*. Retrieved from http://www.phf.org/resourcestools/pages/core_public_health_competencies.aspx
- Dever, G. E. (2006). *Managerial epidemiology: Practice, methods, and concepts*. Sudbury, Mass: Jones and Bartlett Publishers.
- Fileman, G. (1982). *The need for creative managerial epidemiology*. In A. Crichton, & D. Neuhauser (Eds.), *The new epidemiology - A challenge to health administration* (pp. 3 - 14). Arlington: Association of University Programs in Health Administration.
- Fleming, S. T. (2008). *Managerial epidemiology: [concepts and cases]* (2nd ed.). Chicago, IL: Health Administration Press.
- Fos, P. J., Find, D. J., & Zuniga, M. A. (1998). Managerial epidemiology in the health administration curriculum. *Journal of Health Administration Education*, 16(1), 1-12.

- Fos, P. J. (2011). *Epidemiology foundations: The science of public health* (p. 4). San Francisco, CA: Jossey-Bass.
- Friis, R. H., & Sellers, T. A. (2009). *Epidemiology for public health practice* (4th ed., p. 5). Sudbury, Mass: Jones and Bartlett Publishers.
- Gebbie, K. M., Rosenstock, L., Hernandez, L. M., & Institute of Medicine (U.S.) (2003). *Who will keep the public healthy?: Educating public health professionals for the 21st century* (p. 144). Washington, D.C: National Academies Press.
- Gorsky, R. D. (1989). Epidemiology: A liberal art and a professional skill. *Journal of Health Administration Education*, 7(2), 382-388.
- Healthcare Information and Management System Society (HIMSS) (2013). *Health IT Body of Knowledge*. Retrieved from <http://www.himss.org/library/health-it-body-of-knowledge?navItemNumber=16995>
- Hooker, E. A. (2008). Epidemiology in a health services administration curriculum: What topics are important to practicing healthcare administrators? *Journal of Health Administration Education*, 25(2), 127-143.
- Middleton, L. (2012). *Foreword, AUPHA Body of Knowledge for Health Management and Policy*. Retrieved from <https://higherlogicdownload.s3.amazonaws.com/AUPHA/AUPHA%20BoK%20Edited%20122112.pdf?AWSAccessKeyId=AKIAJH5D414FWRALBOUA&Expires=1357781743&Signature=ykM0rhi6fRsK%2BQwxU5ghga%2FUXhE%3D>
- Moehrle, C. (2008). Who conducts epidemiology activities in local public health departments? *Public Health Reports*, 123(Suppl 1), 6-7.
- Moser, M., Ramiah, K., & Ibrahim, M. (2008). Epidemiology core competencies for Master of Public Health students. *Public Health Reports*, 123(Suppl 1), 59-66.
- Neuendorf, K. A. (2002). *The content analysis guidebook* (p. 1). Thousand Oaks, Calif: Sage Publications.
- Riegelman, R. K., & Albertine, S. (2008). *Recommendations for undergraduate public health education*. Retrieved from http://www.aacu.org/public_health/documents/Recommendations_for_Undergraduate_Public_Health_Education.pdf

Roper, W. L., & Cates, W. C. (1993). Managerial epidemiology: the basic science for health reform. *Journal of Health Administration Education*, 11, 621-627.

Thompson, J. D. (1978). Epidemiology and health services administration: Future relationships in practice and education. *Milbank Mem Fund Q Health Soc*, 56(3), 253-273.