PREPAREDNESS AND DISASTER RESPONSE TRAINING FOR VETERINARY STUDENTS: A MODEL FOR ACADEMIC CHANGE THROUGH PARTNERSHIP, COLLABORATION, AND INNOVATION

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ABSTRACT

DIANNE DUNNING: Preparedness and Disaster Response Training for Veterinary Students: A Model for Academic Change Through Partnership, Collaboration and Innovation (Under the direction of Thomas Ricketts)

Background

The nation’s veterinary colleges lack curricula necessary to meet veterinary demands for animal public health and emergency preparedness. A One Health (OH) perspective, which is a collaborative effort of multiple disciplines to promote the optimal health of people, animals, and the environment, could provide the basis for such a training program. To this end, this dissertation explores whether novel thinking and skills, strongly related to OH, can be successfully transferred to students through a single course: the competency-based Veterinary Credentialed Responder (VCR) program at North Carolina State University College of Veterinary Medicine (NCSU CVM). The purpose of the VCR program was to provide cross-disciplinary training necessary for veterinary students to plan for, and respond to, disasters holistically by achieving entry-level federal credentials in emergency response.

Methods

Using the qualitative software package NVIVO-9, thematic content analysis was used to interpret the informal student comments and end of program formal evaluation from the
course using theory-driven themes based upon the tenets of change theory. The VCR program was also evaluated using a comparative thematic analysis of the VCR program and four case histories of change, a pre- and post-knowledge test for three program modules, and student self-evaluations of their skills, confidence levels and perspectives in the defined set of core competencies.

Results

Since 2007, 313 individuals have completed the VCR program. The majority of the respondents agreed that the VCR program made them feel knowledgeable, comfortable and competent in performing duties of OH emergency preparedness and disaster response. Based upon the themes identified in the coding analysis, the VCR program is primarily an example of both teleological (planned) and cultural organizational change which shaped both the development and implementation strategy for the program.

Conclusions

The VCR program has altered the paradigm in disaster preparedness and veterinary public health education by successfully training veterinarians in disaster preparedness. It is offered as a model that can be used by colleges and schools desiring to incorporate OH disaster training into their DVM professional programs. 230/350 words
To my husband (Steve), my children (George Henry and Sydney)

and to my parents (Dave and Donna Dunning)
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American Veterinary Medical Association (AVMA)
Animal and Plant Health Inspection Service (APHIS)
Association of Schools of Public Health (ASPH)
The Council of Linkages between Academia and Public Health Practice (The Council)
Council on Education (COE)
Critical Incident Debriefing (CID)
Federal Emergency Management Agency (FEMA)
Hazardous Material (Hazmat)
Incident Command System (ICS)
National Incident Management System (NIMS)
National Response Framework (NRF)
North Carolina Department of Agriculture and Consumer Services (NCDA&CS)
North Carolina State University College of Veterinary Medicine (NCSU CVM)
United State Department of Agriculture (USDA)
University of North Carolina Chapel Hill (UNC-CH)
Gillings School of Global Public Health (GSGPH)
Personal Protective Equipment (PPE)
Pets Evacuation and Transportation Standards (PETS) Act
Psychological First Aid (PFA)
State Animal Response Team (SART)
Veterinary Credentialed Responder (VCR)
There is nothing more difficult to plan, more doubtful of success, more dangerous to manage than the creation of a new order of things...."

Niccolò Machiavelli, The Prince (1513)

CHAPTER 1: INTRODUCTION

The Doctoral Experience: The Search for a Dissertation Topic and Research Question

In the course of my studies with the Executive Doctoral Program in Health Leadership (DrPH) at the University of North Carolina Gillings School of Global Public Health (UNC-CH GSGPH), I have developed a clear understanding of the benefits of a more comprehensive approach to disaster training and preparedness training within the professional veterinary curriculum. In particular, university veterinary programs need to provide relevant training to prepare students and faculty for successful participation in the sensible resolution of pressing global problems in public health. A global One Health (OH) perspective which is a collaborative effort of multiple disciplines to promote the optimal health of people, animals and the environment, could provide the basis for such a training program. The principle of optimal health is employed here in a restricted sense and does not hold that what is best for public health will be the best for animal or environmental health as often the three domains are in conflict. Ideally, a novel OH training program would, however, take into account the needs of and impact on all three domains in its search for solutions to global health problems.
Currently, medical curricula (and to a certain degree, veterinary curricula) mainly focus on individual-oriented and deterministic risk factors in the search for solutions to global health problems. This narrow view of health and risk filters into public health curricula, and is manifested by methods that promulgate human health as a condition that can be isolated from, and is more important than, environmental health and animal health.\(^{3,4}\) Unfortunately, the premise of this assumption is fundamentally flawed by its unifocal emphasis which disregards much of the greater ecosystem within which we exist. For a paradigm shift in public health to occur, we must first recognize that we live in a larger world than that of our own creation and thereby acknowledge that there are many influences on our health and wellbeing outside our current measurement and control. Adjusting our view of public health to include animals and ecosystems could radically shift our understanding of priorities and thereby change the current public health model so that we truly “see nature in a different way” and experience a shift in our paradigm of public health to population health.\(^5\)

Our world is at a moment of crisis.\(^6-13\) Both medicine (human and veterinary) and public health are in need of a change in focus or a shift in perspective to fully address the scope and depth of modern public health problems.\(^10\) Despite the progress in science, new epidemiological methods, and specialized medicine, the world is still facing a complex set of problems that undermine the health of all living things that cannot be solved through a reductionist application of sophisticated technology.\(^10\) The exploitation of human, domestic animal, and wildlife populations, coupled with globalization manifested by industrial development, increased trade and travel, mismanagement of natural resources and
application of modern technology, has greatly increased the threat of disease transmission across groups.\textsuperscript{11} It is estimated that greater than seventy-five percent of the emerging infectious diseases are zoonotic; the majority of which have their origin in wildlife.\textsuperscript{7,14} However, the capability to identify outbreaks of disease relies on the identification of human cases despite the fact that people serve as a primary reservoir for only 3% of the known zoonotic pathogens.\textsuperscript{7}

Our ability to meet the collective health challenges that we face today will require a collaborative effort that transcends the current predominant disciplines.\textsuperscript{10} For instance, within both our veterinary and human health professions, there is an urgent need to build capacity in emergency management and disaster preparedness. There is an increased need for qualified health professionals who choose population-based careers such as public health and safety as well as volunteers to help respond to future emergencies or disasters. Post-professional training is often too late to optimally capture the interest and energy of a sufficient number of individuals necessary to fully address the gaps in our current public service, emergency management, and especially our volunteer workforces.\textsuperscript{15-17} As a result, veterinary, medical, and public health professional students require additional foundational and experiential components during their formative training to fully prepare them to address the complex issues in disaster preparedness and management. A new paradigm in public health and disaster preparedness requires the integration of a broad set of skills, knowledge, and competencies that span disciplines and necessitates close partnership between governmental agencies, non-governmental organizations and academia.
The primary aim of the DrPH curriculum at the UNC CH GSGPH is to increase health leadership capacity globally and produce first-rate future health leaders. The curriculum focuses on diverse perspectives and experiences across the broad spectrum of public health. Due to my study and work in the DrPH program, I have come to realize that I could contribute substantially to efforts to improve the health of people, animals and the environment by creating a disaster preparedness training program within our professional veterinary curriculum that could also be used as a national model to achieve a more inclusive OH paradigm. Veterinary colleges possess a tremendous resource: academically curious, well-rounded and mature students. Creation of a training program that was embedded as a part of the core curriculum with key strategic collaborative partnerships within government and academia will enable all veterinary students (not just a portion) to graduate with the skill sets and knowledge to contribute to disaster preparedness and emergency management thereby improving capacity and promoting OH within our profession. However, curricular/professional change of this magnitude is difficult to achieve. In order to implement a change of this order, it is useful to review the literature for examples of paradigm shifts within professions as well as the scholarly research on organizational change in order to identify the essential components of successful and unsuccessful change efforts. Through the analysis of this new OH paradigm and curricular change in veterinary medicine, I hope to gain practical insight into how to accomplish full implementation and evaluation of a paradigm shift that will be applicable to any professional health curriculum. Accordingly, this dissertation will describe and evaluate the
effectiveness of new and novel curricula in disaster preparedness and emergency response that incorporates an OH perspective within veterinary medicine.

**The Problem**

We live in a time characterized by bewildering social and scientific complexity.\textsuperscript{18-20} Climate change, bio/agroterrorism, natural disasters, and the ever-growing emergence of drug and multidrug resistant pathogens populate the list of concerns facing the United States and the world.\textsuperscript{9,21,22} Solutions to most of today’s problems will not be found through the models offered by a single discipline or methodology. Today’s complexities, particularly in public health, dictate multi- and cross-disciplinary collaboration and holistic analysis of issues on a systemic basis.

Regrettably, the majority of current public health policies and programs have been based on individual-oriented, deterministic, risk factor methodologies. These trends subjugate the scope and domain of public health to focus on the health of individual people over the ecosystems within which they co-exist.\textsuperscript{3,23} Adding to this problem is that major program funding and emphasis is often too narrowly focused, ignoring the larger ecosystem in favor of a single species. As a result, the unacceptable state of human, animal and ecosystem health in numerous countries around the world forces us to question the historic and current approaches in public health and the policies associated therein.\textsuperscript{23-25}

Advances and increased specialization in epidemiology, sociology and medicine have led to an increasingly narrow concept of public health focused solely on trying to understand the direct determinants of health in human populations.\textsuperscript{3,23} This
anthropocentric trend is a particular problem, as the collective health of the people, animals and the ecosystem can be assured only through the cooperation and collaboration of many individuals in diverse institutional settings, each of which has an important contribution to make to this important and challenging endeavor. Furthermore, forging and sustaining diverse partnerships that emphasize the contributions of multiple determinants of health will lead to an integrated and collaborative health system, one that tends to the entire ecological community and improves collective health of the entire community.

Developing new partnerships within academia and public health agencies at the federal, state and local level will foster and nurture this new integrated cross-disciplinary approach to collective community health. Currently, people who work as professionals in the public health system receive their education and training in a wide range of disciplines and diverse settings, including schools of medicine, nursing, dentistry, social work, allied health professions, pharmacy, law, public administration, veterinary medicine, engineering, environmental sciences, biology, microbiology and journalism. A broader view across disciplines of the full scope of public health practice, a new populations or OH practice is necessary when developing curricular and training programs that ensure optimal communication, information transfer and collaboration.

Although there are numerous federal, state and local agencies that make important contributions through education, training, research and service, these functions are central to the mission of academia. Therefore, academia becomes the logical place to create and
house training programs and educational curricula that embrace a wider cross-disciplinary mandate, one that fully addresses the needs of all: human, animal and the environment.  

**Veterinary Medicine’s Current Role in Public Health**

Among health care professions, veterinary medicine is uniquely positioned to contribute to human, environmental and animal wellbeing. These broad contributions are possible because veterinarians are trained in the enhancement of the health, utility, and productivity of domestic and wild animals. Veterinarians are also enjoined to help humans and society as dictated in the veterinarians’ oath. As such, it is a veterinarian’s professional responsibility to protect people from risks associated with animals and animal products, contribute to the generation of new biological and medical knowledge, protect the quality of the environment, and assist in the preservation of genetic resources.

Veterinary medicine’s service to society has been well demonstrated in a long and distinguished history contributing to the welfare of humans and animals. This has historically been accomplished through veterinarians’ work with livestock, working animals, and food safety/security. However, people's attitudes about animals, their care, and welfare are changing, and veterinary practice is changing as well. Expectations of the standards of care are approaching, and in some cases exceeding, those within human medicine. Food animal/livestock production has undergone sweeping changes which have profoundly changed production practices and the kinds of veterinary services required by the food supply industries. With less than two percent of American families deriving their
income from production farming, agricultural production has shifted from the typical small one-family farm of the past to larger farms and integrated animal industries.\textsuperscript{31}

At the same time, in the last 25 years there has been a decrease in veterinary student interest in food supply practice and training; training that also typically includes disaster preparedness and public service (public practice).\textsuperscript{32} Furthermore, many recent studies have shown dramatic shortfalls of veterinarians in key public health practice areas including food systems veterinary medicine as well as several agencies in the federal government that protect the nation’s food supply and guard against bioterrorism and foreign animal diseases.\textsuperscript{33-36} The existing national pool of 2,800 new veterinarian graduates per year does not meet the demands of a growing population and the changing public health needs of society.\textsuperscript{37}

For the past twenty years, the predominant focus of veterinary training is individual companion animal care.\textsuperscript{32} Fewer than 5\% of new veterinary graduates are choosing to enter public practice.\textsuperscript{32,38,39} It is estimated that 20\% of new graduates, or approximately 500 of the roughly 2,800 newly graduated veterinarians per year, would need to choose a career in population health and public practice to replace and fill all of the current positions in population health and public service in the United States.\textsuperscript{32,38,39} Given that enrollment in US veterinary colleges has been more or less static for the past 20 years, it is not surprising that veterinary medicine is not recruiting or educating a sufficient number of students for careers in these vital areas to serve the needs of society as a whole.\textsuperscript{38} We, therefore, also lack graduates with training, expertise and interest in population veterinary medicine that
can respond to issues regarding agricultural vulnerability to catastrophic disease, either caused naturally, accidentally, or intentionally.17,38,40-49

**A Proposed Paradigm Change in Veterinary Medicine: The Research Problem and Question**

The purpose of this dissertation is to explore a new paradigm in public health training through a veterinary medicine lens and OH perspective.7,9,50 The Veterinary Credentialed Responder (VCR) program at North Carolina State University (NCSU) is part of a novel broad College of Veterinary Medicine (CVM) initiative in Public Health, in partnership with the North Carolina Department of Agriculture and Consumer Services (NCDA&CS), University of North Carolina-Chapel Hill (UNC-CH) Gillings School of Global Public Health (GSGPH), and the North Carolina State Animal Response Team (NC SART). It is the first of its kind in the United States. The VCR program is intended to train all NCSU professional veterinary students to provide leadership and skills in the event of a disaster, agricultural or otherwise. Through the evaluation of this program, I will answer the research problem that guides this study, which is, “**In what way(s) and to what extent does the VCR program orient professional veterinary students towards a more global, comprehensive, inclusive (OH) perspective of Public Health?**” In order to fully answer the research problem, the following research questions were developed:

- **Research Question 1:** What are the key features of the VCR program that orient students towards OH? The answer to Research Question 1 arose from four sources:
A review of the literature regarding paradigm change, which included several key historical examples of paradigm shifts within health professions including the standardization of medical training in 1910 as a response to a Carnegie Foundation Study by Abraham Flexner (commonly referred to as the Flexner Report), the evolution of nursing education from experiential practice to theory driven research, and the most recent trends in medicine towards primary care education. Furthermore, to supplement my understanding of paradigm shifts and second order change, I also surveyed and summarized the literature on change theory at the organizational (with special emphasis placed upon change within the academic environment) and leadership levels.

A review of the literature on disaster training within other health professions (medicine, nursing and dentistry) which also resulted in a theoretical framework which guided the logic model of program design.

A detailed description of the VCR program.

An formal evaluation of both the formative and summative feedback on the VCR program which resulted in alterations of the program to improve its “internalization” of the course objectives by the participants and adoption of the course OH’s perspectives regarding the veterinarian’s role and responsibilities (the course’s affective capability).
• **Research Question 2:** What is the efficacy of the VCR program in orienting and enabling students towards OH-PH practices? The answer to Research Question 2 will come from three sources:
  
  o Student evaluations and feedback.
  
  o Focused interviews with the key faculty and instructors involved with the development and delivery of the course.
  
  o Review/comparative analysis of the literature related to implementing change.

• **Research Question 3:** What are the reported impacts of the VCR program on disaster preparedness? Because the choices our graduates make will occur over several years, and so cannot be evaluated now, the answer to Research Question 3 will only be addressed from a short term standpoint. Data collected will be student feedback regarding the course’s perceived value.
CHAPTER 2: FUNDAMENTAL PRINCIPLES OF PARADIGM SHIFTS: A LITERATURE REVIEW OF CHANGE THEORY

Introduction

This dissertation investigates how an innovative program, such as the Veterinary Credentialed Responder (VCR) curriculum, introduces students towards a new paradigm of thought - beyond the clinical or research based practice of traditional veterinary medicine. I posit that if the VCR program is a truly effective model of One Health disaster and emergency management training, then students attending the program will consider it their professional responsibility to provide service and capacity across species boundaries. Since there is no single discipline that incorporates the knowledge upon which this inquiry is based, this literature review is broad and examines the phenomenon of change from a variety of perspectives and sources.

After a discussion detailing the search protocol and literature eligibility criteria, the first section will define “paradigm change” and review three historical case examples of change within the medical and nursing professions. The next section will review the dominant models, theories and key concepts of change at organizational and leadership levels. In the third section, special attention will be placed on change within an academic environment as that is the focus and context of this particular paradigm change. These sections will provide the foundation of knowledge, the historical perspective, and the
context leading to the final chapter, which will provide the theoretical framework for the VCR construct needed to create change both at the organization (college/university) and professional (organizational) level within veterinary medicine.

Search Protocol and Literature Eligibility Criteria

An extensive literature review was performed in order to address the research problem and investigate curricular training models that effectively achieve and sustain paradigm shifts and programmatic/professional/behavioral change within an academic setting. As such, this particular literature review explores the research related to teaching new paradigms to health professions. In addition, salient papers, articles and books were gathered to understand the context of change, leadership and management of change, and change theory (from an organizational and leadership standpoint) including theories of evolitional, planned, lifecycle, dialectical, social, and cultural change.

For this literature review, both ERIC and Medline were searched for references from 1967 to the present. Initially, ERIC was searched using the term “Medical Education” which was then exploded to include the broader term “Professional Education” and narrower terms (“Veterinary Medical,” “Graduate Medical Education,” “Nursing Education,” “Pharmaceutical Education”) and related terms (“Premedical Students,” “Problem Based Learning,” “Allied Health Occupations Education,” “Clinical Experience,” “Clinical Teaching (Health Professionals),” “Dental Schools,” “Health Occupations,” “Health Personnel,” “Medical Schools,” “Medical Students,” “Medicine,” AND “Educational Change.” Limiting the search to the English language yielded 425 results. To be eligible for inclusion within this literature review, each article or text
had to comprehensively describe or evaluate change at the organizational level. Exclusion criteria included articles that focused on change at the local/group or individual level/degree. After a survey of the titles and abstracts, 69 articles remained. Additional terms that were searched in conjunction with “Medical Education” (with results limited to the English language) included: “Population” (315 titles and abstracts surveyed/10 remained), “Population Medicine” (1/1), “Population Health” (10/2), “World View” (10/1), “Ecology” (6/2), “Theory Practice Relationship” (140/5), “and Nursing Theory” (1/1). Again, surveying the titles and abstracts of these terms yielded 22 articles total. Furthermore, the exploded terms of “Medical Education” and “Innovation” were also searched, limited to the English language, and yielded 110 articles, but upon cursory review the focus of these articles was not profound paradigm change. Medline was also searched to augment this comprehensive review using the following MeSH keywords: ((“Education, Medical”[Mesh] OR (“Education, Medical/organization and administration” OR “Education, Medical/trends”[Mesh]))) AND (“Organization Innovation”[Mesh] OR “Organizational Innovation/trends”[Mesh]). Again, limiting this search to the English language yielded 507 results. Upon review of the title and abstract content, with similar exclusion and inclusion criteria, 54 articles remained.

In total 145 articles were fully surveyed and sorted based upon relevant content. Upon completion, 21 articles remained for full review, including the Carnegie Study by Abraham Flexner (commonly referred to as the Flexner Report). Furthermore, these reference lists were “snowballed” (a recognized literature methodology to using key references to identify additional articles or resources to supplement the literature review$^{51}$) to yield an additional 23 articles. Finally, a separate search of the seminal literature in change theory was also
completed which focused on theories of diffusion of innovation, academic change, planned change, mandated change, and change leadership. The definition of a seminal work is an article or book from which other works grow.\textsuperscript{52,53} These articles and books were identified in review articles as seminal works within the field of change theory. This search yielded 27 books and 18 articles.
Figure 1. Distribution of articles included in the full literature review on paradigm shifts and change.

- Professional Education AND Educational Change (425)
- Medical Education AND Population (315)
- Population Medicine (1)
- Population Health (10)
- Worldview (10)
- Ecology (6)
- Theory Practice Relationship (140)
- Nursing Theory (1)

Eric (908)

Medline (507)

- ["Education, Medical"[Mesh] OR "Education, Medical/organization and administration" OR "Education, Medical/trends"[Mesh]]
- "Organization Innovation"[Mesh] OR "Organizational Innovation/trends"[Mesh])

91 abstracts and titles reviewed

54 abstracts and titles reviewed

21 full articles reviewed; excluding seminal textbooks and journal articles

89 articles and books total

Seminal review of the literature on change theory yielding 18 articles and 27

Snowball (23)
The Terminology of Change

To facilitate the understanding and comprehension of the fundamental principles within this section, the following terms are briefly defined and reviewed below.

Change theory is the study of methods used to incorporate new information into a knowledge base when the new information may conflict with existing information.\(^{54}\) Examples of change theories include the following six major typologies of change which will be discussed later in this chapter: evolutionary, teleological, life cycle, dialectical, social cognition, and culture.\(^{55}\)

Metaparadigm represents the worldview of a discipline (the most global perspective that subsumes more specific views and approaches to the central concepts with which it is concerned). For instance, there is considerable agreement that Nursing’s metaparadigm consists of the central concepts of person, environment, health and nursing.\(^{56-60}\)

Paradigms are a set of rules and regulations that establish or delineate boundaries and direct perceptions, thoughts and behaviors.\(^{5,61}\) The definition of public health is “the health of the public (people)”. The paradigm of public health operates under this rubric (and others) where the art and science of preventing disease, prolonging life, and promoting physical and mental health, sanitation, personal hygiene, control of infection, and organization of health services is focused on mainly on human health endpoints and outcomes.\(^{5,62}\)
A **paradigm shift** is the fundamental shift in opinion or attitude that results in a change in approach, belief, or practice.\(^5\,^6\) This concept will be discussed in greater detail in the next section.

A **theory** is a creative and rigorous structuring of ideas that project a tentative, purposeful and systematic view of phenomenon.\(^5\,^7\,^6\) 'Multiple causation' is a key principle of modern epidemiology and commonly referred to as 'web of causation” theory.\(^6\) First articulated in the 1960s, web of causation theory remains a widely accepted model, reflecting our current biological and social understanding of population patterns of health and disease.\(^6\)

A **tenet** is defined as any opinion, guiding principle, doctrine, dogma, etc., especially one held as true by members of a profession, group, or movement.\(^6\) One of the fundamental tenets of clinical medicine is *primum non nocere*: “First do no harm.”

A **construct** is defined as an image, idea, or theory, especially a complex one, formed from a number of simpler elements. Sometimes this term is used interchangeably with concept, however, a construct is most often defined as more abstract than a concept.\(^5\,^9\,^6\,^7\) For example, if “quality of life” is a concept, a theoretical model of “quality of life” would be a construct such as Health Related Quality of Life, which can be defined as the value assigned to the duration of life as modified by the social opportunities, perceptions, functional states, and impairments that are influenced by disease, injuries, treatments or policies.\(^7\)

**Theoretical models** (frameworks) represent a proposed framework of ideas or worldview structure comprised of concepts which are described and
interconnected. This is a formalized version of a construct and is therefore often used interchangeably.

**Single loop learning** is defined as a problem solving process that entails changing actions or strategies for achieving a desired result without changing the underlying theory or assumptions about those actions. Whereas, **double loop learning** is defined by a problem solving process characterized by changing fundamental values and assumptions of the theory as well as the strategy and actions. An example of single loop learning is the detection of an error (such as a miscalculation of a drug dose) and a correction of an error (recalculation and distribution of a drug) by a pharmacist. Double loop learning occurs when, in addition to the detection and correction of an error, the pharmacist involved recognizes that there is a problem with medication errors and institutes a quality improvement program to provide a structure for identifying problems and recognizing opportunities for improvements in drug dispensing and pharmacy practice.

**Paradigm Change Defined and Examined**

Paradigms are defined as a set of rules and regulations that establish or delineate boundaries and direct perceptions, thoughts and behaviors. As such, paradigms are based in accepted theories of normal practice and tradition, and are usually shared by or agreed upon by a majority of members within a community. Often, they are helpful as they allow us to develop expectations of what will or will not occur based upon our past experiences or knowledge. As such, a paradigm shift is defined as a fundamental shift in
assumptions that results in a change in approach, belief, or practice and is most commonly associated with cultural change theory typology, described in detail later in this chapter.\textsuperscript{5,61}

The term paradigm shift was first described and popularized in 1962 by Thomas Kuhn in his book, \textit{The Structure of a Scientific Revolution}, in which he explored and discussed the concept of change or scientific revolution within the natural or physical sciences, such as physics, chemistry, biology, geology or astronomy.\textsuperscript{5} Dr. Kuhn was an American physicist who wrote extensively on the history, sociology and philosophy of science. According to Dr. Kuhn, a paradigm change (or shift) transpires when data or information falls outside the expected “bell curve” of common perceptions, challenging our fundamental understanding of a situation.\textsuperscript{5} Therefore, it should come as no surprise that a prerequisite to any paradigm change is a general awareness of anomalies.\textsuperscript{5} Once an individual (or organization) is aware of the abnormalities within the scientific construct, there is an alteration of the existing worldview that results in a new understanding of the surrounding informational landscape.\textsuperscript{5} True paradigm shifts require more than different driving directions and detours – they require new topographical maps. The decision to accept a new paradigm must be made simultaneously with the decision to reject a previously held belief.\textsuperscript{5} Kuhn maintained that these shifts are a part the usual developmental pattern of a mature science and therefore, are an indication of scientific progress.\textsuperscript{5} Historical examples of classic paradigm shifts within medicine are numerous and include the shift in understanding of disease as a curse (ancient healers were generally religious leaders or clerics) to disease being viewed as miasmic (caused by sewer gases, garbage fumes, and poor sanitation) to the discovery of microbes (which gave rise to the
Great Sanitary Awaking and the rise of the modern organized public health movement).\(^{71,72}\)

Finally, as Koch’s postulates failed to explain the nonrandom distribution of disease (e.g. chronic disease) within any given group, a new paradigm of epidemiology has emerged, which accounts for the interrelationship of multiple factors that contribute to the occurrence of a disease (the web of causation).\(^{73}\).

The concept of paradigm shifts has also been embraced by the social sciences, which also unfortunately has lead to the term being overused (and, in some cases, abused) and misapplied.\(^{74}\) Kuhn himself believed that the paradigm shift concept was only applicable to the natural or physical sciences due to the hermeneutic and subjective nature of the social sciences.\(^{5}\) Nonetheless, the paradigm shift concept, when appropriately applied, is a very useful guiding concept when considering implementation of programmatic innovation and organizational change. Although philosophers (and students) argue the significance of this philosophical contribution, its impact has been long lasting.

**Case Histories of Paradigm Change within the Health Professions**

There are many historical examples of paradigm change described in science. However, the present inquiry limits the exploration and description to the changes in professional paradigms related to the health professions. Four paradigm shifts will be discussed below, each of which highlights the conditions and parameters necessary to evoke a change in world view that has a lasting and permanent effect.
Case History 1: Carnegie Foundation Bulletin No. 4: The Flexner Report and its impact on medical training in the US

Currently, in 2011, there are 133 colleges of medicine and 26 accredited colleges of osteopathic medicine in the United States that offer MD or DO degrees for physicians. 75,76 With standardized admissions and entry criteria, course content, and teaching methodology, modern medical education and training in the United States is both rigorous and demanding. However, this difficult, uniform educational paradigm was not always the norm. In the nineteenth century, there were over four hundred medical schools in the United States and most medical education was administered through one of three basic routes: 1) apprenticeship, where students received hands-on instruction from a local practitioner; 2) a proprietary schools system, in which groups of students attended a course of lectures from physicians who owned the medical college; or 3) a university based system, in which students received some combination of didactic and clinical training at university affiliated lecture halls and hospitals. 77 Medical training bore little “unity of purpose or standards” and there was an “an enormous over-production of uneducated and ill-trained medical practitioners.” 78 Medical training consisted of a variety of topics, including scientific, osteopathic, homeopathic, chiropractic, eclectic, physiomedical, botanical and Thomsonian practice (for example, practitioners of Thomsonian medicine believed that “heat is life, and cold is death” and therefore utilized vomiting, sweating, and purging to cure their patients). 79 The heterogeneity of educational experience and paucity of licensing examinations led to medical professionals who varied tremendously in their medical knowledge, therapeutic approaches, and capabilities. 80
A Call for Change within the Medical Profession

Due to the lack of standards in practice and variability of training, the medical profession felt compelled to self-organize and founded the American Medical Association (AMA) in 1847, which strove to elevate the standard of medical education in the United States by advancing the science of medicine, improving the standards for medical education, developing a program of medical ethics, and improving the health of the public for the purpose of self-regulation of the profession. With the founding of the AMA, medical reform was slowly underway, although many physicians thought the association’s goals to be “impractical, if not utopian.” Throughout the second half of the 19th century, the AMA lobbied for the standardization of American medical education with little success. Unfortunately, political traditions of “republicanism” and a distaste of authoritative rule dissuaded and delayed any national regulation of the medical profession. Additionally, the majority of patients and the general public were unconvinced and lacked knowledge of the superiority of any specific medical training, system, or discipline.

However, there were several shifts by the end of the century that served to galvanize the medical profession and the general public at large. A series of scientific breakthroughs altered the values of the general public and the medical profession. Antiseptic surgery, vaccination, and public sanitation had all proven therapeutic efficacy and gained public acceptance. Moreover, the “heroic medicine” of the Victorian Age, which included blistering, bleeding, purging and sweating, was falling out of favor due to mounting clinical evidence disproving its effectiveness. Due to these changes, there was a growing
consensus among physicians and educators that any form of medical education must now 
be based in the scientific method, with students spending significant time in the clinical and 
laboratory settings of a hospital.77

During this timeframe, the AMA led the effort to eliminate schools that failed to 
adhere to a more rigorous brand of systematized, science based medical education. In 
1904, the AMA created the Council on Medical Education (CME) to further promote the 
restructuring of US medical schools.72 Two of its first major reform initiatives were to 
standardize the preliminary education requirements for entry into medical school and 
national implementation of an “ideal” medical education, consisting of two years of training 
in laboratory sciences, followed by two years of clinical rotations in a teaching hospital.72,77
To promote the AMA’s reformist agenda and accelerate the elimination of inadequate 
medical schools, the CME proposed to survey all US medical schools on five areas: 1) 
admissions requirements, 2) size of faculty and the quality of their credentials, 3) size of 
endowment and tuition, 4) quality of laboratory facilities, and 5) availability of a teaching 
hospital whose physicians and surgeons would serve as clinical faculty.77,78,81 In 1908, the 
CME commissioned the Carnegie Foundation for the Advancement of Teaching and Dr. 
Abraham Flexner to lead the initiative.77-79,81-84

Abraham Flexner and the Foundation for the Advancement of Teaching

Abraham Flexner (1866-1959) was a classics scholar and former schoolmaster, who 
believed that education should prepare an individual for the responsibilities of citizenship, 
for an occupation or a profession, and be utilitarian in nature.85 He favored what came to
be known as progressive education, which was based upon the theories and concepts of the philosopher and educational reformer, John Dewey. Like Dewey, Flexner strongly believed in a balance between knowledge delivery and students' actual experiences and process of active learning. In addition, based upon his experience and training in education, Flexner maintained that research and teaching were inseparable and that the clinician and scientist were one in the same, bridging the gap between basic and clinical science in an effort to build a more science-based medical discipline. He also postulated that didactic lectures had limited usefulness in teaching the laboratory sciences, and that it was essential to supplement learning with textbooks, experiments, and laboratory and clinical work. In essence, Flexner strongly believed that one learned medicine by doing.

In 1908, the number of medical colleges had decreased, but they still differed greatly in their curricula, methods of assessment, and requirements for admission and graduation. Over the course of 18 months, Flexner reportedly visited 155 of the operating US graduate and 12 postgraduate medical schools. Flexner's report uncovered and exposed serious inconsistencies at many of the institutions between claims of progressive, scientific principles of the mission of medical education and a lack of the human, financial and facility resources necessary to support such ambitious endeavors. However, there were several schools that received praise for excellent performance, educational standards and modern facilities. These included Harvard, Western Reserve, Michigan, Wake Forest University School of Medicine, McGill, University of Toronto, and Johns Hopkins, which Flexner latter describe has his 'model for medical education'. The strength of Flexner’s message resided within his conviction of the
necessity of science within medical practice, the comprehensive and thorough nature of his survey, and the universal appeal of his message to the American public.\(^{83}\) Although medical reform had been underway for fifty years previous, Flexner’s report catalyzed change by defining the problems facing medical education at the turn of the century and laying a clear and tangible path for reform. Table 1 details a summary of Flexner’s Educational Philosophy from the Carnegie Foundation Bulletin No. 4.\(^{78,86}\)

**Table 1. Summary of Flexner’s Educational Philosophy, Modeled after John’s Hopkins School of Medicine’s Program.\(^{78,81,84-86}\)**

<table>
<thead>
<tr>
<th>PHILOSOPHICAL MANDATE</th>
<th>SUMMARY DETAILS</th>
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<tr>
<td>Learn by doing</td>
<td>Consider the utility of what is being taught, do not make the educational process too long, consider professional medical students as adult learners, but provide them with reasonable curricular pathways, depending upon their career choices, and finally, teach medicine as a scientific discipline at both the preclinical and clinical levels.</td>
</tr>
<tr>
<td>Linking medical training to academia</td>
<td>All medical colleges must have a direct link and relationship with a parent university.</td>
</tr>
<tr>
<td>Mandating a university based hospital experience within medical training</td>
<td>Each medical school must have a university hospital in which the staff constitutes the teaching faculty.</td>
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**Criticisms of the Flexner Report**

Although the Flexner report continues to be hailed as one of the most significant documents which led to the reform of medical education, it is not without its flaws. The frank candor and caustic nature of its reporting on the conditions of many of the medical schools, led to an immediate and profound reaction across the country.\(^{87}\) Many leaders in the academic medicine found the Flexner Report to be intemperate and unfair and accused the report of being: 1) **misinformed** (Flexner was not a physician and only had
a cursory understanding of medicine), 2) **biased and unduly influenced** by the Carnegie Foundation, the Rockefeller General Education Board, and AMA which supported allopathic over other sects/disciplines of medicine and did not favor proprietary, for-profit institutions of training, 3) **cursory in its review of the schools** and that it overlooked many of the efforts of improvement particularly in the rural, poor institutions, 4) **hasty** (Flexner finished his tour of schools within less than a year, reportedly spending less than one hour at some institutions and none at others, and 5) **unfair**, as it recommended closure of all three women’s colleges and five of the seven black colleges due to a perceived lack of demand, thereby limiting enrollment to the Caucasian male. 87

Despite these charges, Flexner’s report was very influential.77-79,82-85,87 Rallying around Flexner’s medical education philosophy, the combined efforts of the state licensing board, philanthropic foundations, and the Federation of State Medical Boards, which voluntarily agreed to base their accreditation policies on the AMA’s CME academic standards, resulted in the eradication of proprietary medical colleges and the standardization of the laboratory- and hospital-based research medical university model that Flexner advocated in his report.77,78,85

One hundred years ago, Abraham Flexner’s critique of medical education evoked a profound paradigm change within medical education and society as a whole, laying the groundwork for what is now known as the modern medical curriculum.83 Flexner’s model of change has relevant lessons to learn for those seeking innovative change within education today.
Case History 2: The Evolution of Nursing Theory: From Nightingale to Metaparadigm

By definition, nursing is the provision of services essential to prevent illness or to promote, maintain, and restore health and well-being. Nursing research and theory is a systemic inquiry designed to develop knowledge about core issues of the nursing profession and articulate a normative standard for its practice. The current spectrum of nursing theory covers a diversity of topics, models, and constructs related to the fundamental practice of nursing, education, administration and informatics. Originally, however, nursing theory’s essential aim was to define nursing as a profession distinct from other health disciplines and to differentiate expert nursing from a dependent, subservient, task-oriented vocation.

Florence Nightingale

Although the origins of nursing pre-date the mid-19th century, the history of professional nursing traditionally begins with Florence Nightingale. Nightingale’s philosophical perspective and teachings, as detailed in her 1912 landmark book, Notes on Nursing: What It is and What It is Not, set the foundation of nursing training, education, and theory that has been practiced for the last century and a half. In 1860, modern practices of health were only just being discovered. The ideas, values and beliefs expressed in the thin book of 136 pages were revolutionary to the wellbeing and care of the 19th century patient, when being hospitalized was akin to a death sentence and nurses were still mainly regarded as ignorant, uneducated persons.
Throughout her long career, Nightingale fought for the recognition of nursing as a profession and academic discipline with a distinct body of knowledge.\textsuperscript{92} Despite her efforts, it was more than 100 years before nursing shed its vocational heritage and began serious discussion about the need to develop, articulate, and test nursing theory.\textsuperscript{92} In the 1950s, the first nursing research journal was established which led to a growing body of peer-reviewed evidenced-based literature.\textsuperscript{57,61,90,92,96,101,104,105} A review of this body of literature in the mid-1970s revealed, however, that it consisted mainly in course selection and curricular content and that the nursing profession still lacked the conceptual connections and theoretical frameworks necessary to truly define its mission.\textsuperscript{56,57,92} Tandem to the critical literature review, there was a concurrent movement to establish and accredit independent graduate level programs of study through the League for Nursing across the United States for both master and doctoral nursing students.\textsuperscript{92} The transition from vocation to profession was made at this juncture by the leaders within the emerging discipline asking a simple but obvious question, “Will nursing be based in other disciplines of health or be based in the inherent tenets of nursing care?”\textsuperscript{91,92}

\textit{Jacqueline Fawcett and the Metaparadigm of Nursing}

In answer to this question, Dr. Jacqueline Fawcett proposed a metaparadigm of nursing.\textsuperscript{56,59,60} According to Fawcett, a metaparadigm represents the worldview of a discipline or the most global perspective that subsumes more specific views and approaches to the central concepts with which it is concerned.\textsuperscript{56,58-60} Fawcett’s proposal introduced an organizing structure for the existing frameworks within the nursing literature and spelled out the phenomena of nursing in its most global manner.\textsuperscript{56-59} Interestingly, much of the
metaparadigm’s foundation was firmly rooted in Nightingale’s original observations and philosophies on nursing, which demarcated the discipline into four areas of focus: the patient, the environment, the health (or illness) entailed, and the nurse. These four areas have been recurring themes within the literature and works of nursing scholars since Nightingale. Fawcett went on to define three disciplines (areas of study) within the defined nursing metaparadigm (Table 2).

Table 2. Three disciplines of study within the nursing metaparadigm.56

<table>
<thead>
<tr>
<th>AREAS OF STUDY</th>
<th>TOPIC</th>
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<tr>
<td>The principles and laws that govern the life process, wellbeing, and optimum functions of humans sick or well</td>
<td></td>
</tr>
<tr>
<td>The patterning of human behavior in interaction with the environment in normal life events and critical life situations</td>
<td></td>
</tr>
<tr>
<td>The process by which positive changes in health status are affected</td>
<td></td>
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</tbody>
</table>

The development and maturation of the nursing profession through training, education and the promotion of nursing theory brings Kuhn’s ideas of paradigm shift to life. Nightingale and other nursing leaders across the country systematically attempted to bring structure and cohesion to the discipline of nursing practice. Nursing theory emerged as a product of a decade of scholarship by individuals within the fledgling nursing profession who sought higher education and realized the limitations of the previous paradigm of nursing as a vocation shackled to other disciplines such as medicine. Through their collective efforts to establish a scientific basis for nursing management, curricula, practice, and research, a convergence of ideas resulted in the emergence of what is referred to today as nursing theory, which serves as the organizing structure for the profession as a whole.
Case History 3: Paradigm shift failed: A continued struggle to build national capacity and competency in primary care medicine

Primary care is currently defined as the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing sustained partnerships with patients, and who practice in the context of family and community. Until World War II, healthcare in the United States was essentially provided by the family or general practitioner with specialty medicine being accessible by referral only. The shift away from this primary care model began during this time period, with the arrival of specialty training practice and the advent of pediatric and internal medicine specialty boards (established in 1933 and 1936, respectively).

Prior to World War II

In the 1920s, notwithstanding the reforms in medical education following the 1910 publication of the “Flexner Report” and the concurrent advances in medical science at the end of the 19th century, many medical and health professionals remained dissatisfied with progress in improving general health and wellbeing in the US. Therefore, in May 1927, leaders of medicine, public health, and social sciences met at the annual meeting of the American Medical Association (AMA) and established the Committee on the Costs of Medical Care (CCMC) which would comprehensively study the economics of health care over the subsequent five-year period. The CCMC’s studies were broad in scope, evaluating issues related to medical care needs, resources, and expenditure; professional and institutional investments, costs and incomes; standards of good care; existing provisions and practices in representative communities illness, care and cost among
representative families; the costs of medicines and various types of services; the ability to pay for medical care; and the special organized provisions made to serve particular groups or enable people to pay for the cost of health care.\textsuperscript{116,117,119,121} Due to the committee’s broad mandate and diverse composition, the CCMC was unable to reach unanimity for its final recommendations.\textsuperscript{116,117,119,121} Therefore, the final recommendations of the group came in the form of five seminal (majority) and several minority recommendations regarding the healthcare needs of US citizens.\textsuperscript{117-121} Although the majority and minority proposals were distinct, they were closely accordant.\textsuperscript{120,121} Briefly the majority recommendations were: 1) Medical services, preventive and therapeutic, should be provided by interdisciplinary groups; 2) Basic public health services should be available to all without cost; 3) The costs of medical care should be placed on a group basis (insurance, taxation, or a combination thereof); 4) Study, evaluation, and coordination of medical and public health services should be important functions for local and state governments; and 5) Professional education for a wide variety of medical and public health personnel should be greatly expanded with emphasis on prevention and social considerations.\textsuperscript{117-120 121}

Upon release of the CCMC final report, the AMA characterized the recommendations as an incitement to revolution.\textsuperscript{117-120} Further undermining any momentum for reform, established newsprint organizations, such as the New York Times, the Wall Street Journal and the Washington Star published front page stories with headlines reading, “Socialized Medicine is Urged in Survey.” The debate on health care economics quickly disintegrated into a war of alliances rather than a reasoned policy debate rooted in the science of economics and epidemiology.\textsuperscript{117,119,120}
The 1960s

The actual term “primary care” began to appear in the literature in the early 1960s, first originating in a 1961 article by Dr. Kerr White entitled “The ecology of medical care,” which endorsed the primary care model to address the majority of health care problems. Concerned with the decline of general practitioners as key providers of primary care, US medical and political leaders commissioned several more major reports in the 1960s that supported the formation of a family practice specialty college. Family medicine was officially recognized as an independent discipline and as the twentieth specialty in the US, when the American Board of Family Practice was established in 1969. With the rapid establishment of departments of family practice in two-thirds of the medical schools and the growth of graduate training, the numbers of residents in family medicine grew from a total of 290 residents in 1970 to over 6,000 in 1978 which lead to a reversal of a 50-year trend of falling numbers of family and primary care physicians in the US.

Despite these well placed efforts, the 1990s bore witness to a projected shortage of primary care physicians. Specifically, since 1997, the numbers enrolled in the specialty of family practice at medical schools declined and continues to be one of the most difficult issues in medicine today. In total, the number of general practice physicians continued to decline from 71,366 in 1965 to 42,374 in 1975. Meanwhile, physician numbers grew within specialty practice as a direct result of numerous federal and state policies which provided financial and programmatic support for the perceived general shortages of physicians.
In a direct effort to ameliorate this trend, the training of physician assistants and nurse practitioners was established during this period, with the specific intent of filling part of the perceived gap left by the physician shortage.\textsuperscript{109,123} Furthermore, Title VII of the Public Health Services Act, enacted in 1963, and Title VIII (nurses), enacted in 1964, were created in response to a shortage of health care providers. Both Titles were enacted with the specific intent of increasing the number of underrepresented minorities in the health care field which, it was hoped, would in turn help improve access to care for racial and ethnic minorities, low-income people and other medically underserved patients.\textsuperscript{109,123}

\textit{The 1970s}

By the late 1970s, awareness of the primary care shortages culminated in increased funding and programmatic support for the training of general internists and general pediatricians in addition to family practitioners.\textsuperscript{109,111,112,123} In 1978, the Institute of Medicine (IOM) issued a report entitled, “A Manpower Policy for Primary Care.” This report contained many recommendations which emphasized the need to shift medical training towards primary care.\textsuperscript{109-112,114,127} Unfortunately, the report’s recommendations were largely ignored.\textsuperscript{109} During this time, specialty care medicine rapidly grew in the US and throughout the world.\textsuperscript{113-116}

\textit{Current Trends and Unresolved Issues}

According to American Association of Medical Colleges (AAMC) data, the number of physicians entering general practice or primary care after residency are down from 8,162 in 2000 to an estimated low of 6,757 in 2007.\textsuperscript{115} Currently, primary care practitioners
comprise 35 percent of practicing physicians, but their numbers are declining due to an aging work force with increased retirements and fewer new doctors to replace them.\textsuperscript{115}

Furthermore, recent Council on Graduate Medical Education (COGME) studies revealed that fewer than 20 percent of all U.S. medical students are choosing primary care specialties.\textsuperscript{115}

Why have the efforts and organization of concerned physicians and health care advocates over the past 100 years failed to ameliorate the supply shortage and distribution of primary care physicians? Critical examination of historical events reveals no simple answers or singular failure points. Rather, the failure here is multi-factorial and wide-ranging in nature which includes the financing and delivery of health care services and the status and compensation of the family care physician within the medical profession\textsuperscript{128,129}.

Applying the tools of diffusion of innovation and change theory analysis, key factors contributing to the success or failure of paradigm shifts emerge. In this particular case, the solutions proposed to the primary care shortages may not yet meet the criteria for a paradigm shift and therefore involves only minor or temporary adjustments or improvements to the problem.\textsuperscript{130-132} A change of a second order nature may be needed to create a shift at medicine’s core to increase primary care capacity.\textsuperscript{130-132}


In a global society, where health threats range from pandemic disease, catastrophic disasters, and large-scale bio/agroterrorism, a diverse, motivated group of agencies and partners committed to achieving the objective of Healthy People Initiatives realized that
there is an urgent need for an effective public health system. In particular, academicians and scientists realized that they must redefine how they educate our future health professionals to meet the current challenges threatening the public’s health. An effective public health system requires a workforce of well-educated public health professionals. Currently, public health professionals receive education and training from a wide range of disciplines, come from a wide variety of professions, work in a variety of settings, and command a large number of skill sets.

A Collaborative Approach to Curricular Change

In 2002, the Association for Prevention Teaching and Research (APTR) established the Healthy People Curriculum Task Force (HPCT). The HPCT’s specific charge was to fulfill Objective 1.7 of the Healthy People 2010 initiative and to "increase the proportion of schools of medicine, schools of nursing and health professional training schools whose basic curriculum for health care providers includes the core competencies in health promotion and disease prevention." Eight clinical health professional education associations participated on the task force (Association of Schools of Allied Health Professions (ASAHP), Association of American Medical Colleges (AAMC), American Dental Education Association (ADEA), American Association of Colleges of Nursing (AACN), National Organization of Nurse Practitioners Faculties (NONPF), American Association of College of Osteopathic Medicine (AACOM), American Association of Colleges of Pharmacy (AACP), and the Physician Assistant Education Association (PAEA)).

The result of this unique collaborative effort was the publication of The Clinical Prevention and Population Health Curriculum Framework (hereafter referred to as
The Framework) in 2004. The Framework’s goal was to provide a platform for 1) communication and collaboration within and among health professions, 2) organizing curriculum, and 3) monitoring curriculum.\textsuperscript{138,140}

As such, The Framework provided a set of four components or categories and nineteen domains or topics that constitute a foundation for education in clinical prevention and population health (Table 3).\textsuperscript{138} Specifically, it was hoped that academicians and educators from participating clinical health professions would to utilize The Framework’s recommendations as a basis for curricular change within their own professional education program.\textsuperscript{138,139,142} Realizing that there was need for flexibility for each clinical health profession to determine the depth of curriculum that is recommended, the timing for the teaching material and the methods for delivery, the HPCT chose not to identify specific competencies or learning objectives.\textsuperscript{138} The goal was to provide general recommendations and identify content area that may require greater emphasis within professional degree programs.\textsuperscript{138}

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>DOMAINS</th>
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<tbody>
<tr>
<td>Evidence Base of Practice</td>
<td>Epidemiology and biostatistics</td>
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<td></td>
<td>Methods for evaluating health research literature</td>
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<td>Outcomes measurement, including quality and costs</td>
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<td>Health surveillance</td>
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<td>Determinants of health</td>
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<tr>
<td>Clinical Preventive Services – Health Promotion</td>
<td>Screening</td>
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<td></td>
<td>Counseling</td>
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<td></td>
<td>Immunization</td>
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<td></td>
<td>Chemoprevention</td>
</tr>
<tr>
<td>Health Systems and Health Policy</td>
<td>Organization of clinical and public health systems</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Community Aspects of Practice</th>
<th>Communicating and sharing health information with the public</th>
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<tbody>
<tr>
<td></td>
<td>Environmental health</td>
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<td></td>
<td>Occupational health</td>
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<td>Global health issues</td>
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<td>Cultural dimension of practice</td>
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<td></td>
<td>Community services</td>
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</table>

The Response to the Framework

During the six years since the publication of the Framework, the Task Force members have been active in its dissemination to their respective professional programs. Each HPTF participant introduced its members to the Framework through distribution through their member institutions and discussion with the deans and academic leadership. As expected, given the uniqueness of each of the professional organizations political and organizational dynamics, the response was varied. Three organizations, the AACN, ADEA, and the PAEA, officially approved or endorsed the Framework and the AACP developed targeted educational outcomes for its curriculum. Other individual professional schools and college utilized the proposed framework as an assessment tool to evaluate their curricula and to developed new education opportunities in public health. However, the Framework has yet to be adopted or fully embraced across the remaining professions within the task force, most notably the medical profession. Conspicuously, the veterinary profession was not engaged in this conversation as well.

Although the ATPM and the HPTF were commended for their work, many leaders within the member organizations expressed concern regarding the breadth of the Framework and
thus its implementation. Creating new courses with additional contact hours for students was seen as problematic from both a logistical and political standpoint. Furthermore, a certain degree of concern was voiced regarding the prescriptive nature of the framework and the limitations of creating a common curricular framework considering the diversity of disciplines across the health professions, each with individual areas of need in terms of expertise, focus and emphasis. Despite these areas of concern, the Framework was seen as a positive step towards increasing the prevention content of clinical health professional education. Much work was necessary to move the Framework into practice. The HPTF now envisions a decade-long process to define and implement specific learning outcomes that can be integrated across the educational continuum. Furthermore, interprofessional education and collaboration is now seen by the Task Force as a key method for implementation of the Framework. More emphasis has also been placed on the understanding of the variety of roles to be played by all the health professions to address the nation’s prevention and public health priorities. The original Framework’s educational objectives have been revised to provide a vehicle for promoting this interdisciplinary discussion and curricular innovation that connects the health professions through education.

**Understanding and Facilitating Change**

The purpose of this section is to review some of the common concepts related to organizational change, using the four previous historical cases to facilitate the overall understanding of the concept of change. Additionally, use of the case histories will assist in
the demonstration of how these fundamental concepts may be applied in other
areas/disciplines/professions. Not all organizational change is necessarily paradigmatic in
nature (nor should it be). The definitions and terminology within this section will attempt
to explain the why, what and how of change, which are the essential common elements of
all models of change. Furthermore, the answers to these questions are critical to the
successful implementation of change.

What is Organizational Change?

Organizational change, in its most generic form, refers to changes among individuals
and groups in an organization, as well as changes to the structure and function of the
organization itself. Before embarking on a discussion of concepts common to all
change models, it is helpful to define and discuss some of the common terms utilized within
the field of organizational change. These lessons are widely applicable to the analysis of the
VCR Program, the implementation of OH in veterinary medicine, and any organization that
is embarking on a change effort.

Popularized by Everett Rogers in his 1962 book, Diffusion of Innovations, diffusion is
the process in which an innovation is communicated through certain channels over time
among members of a social system. A key characteristic of diffusion theory is the
incorporation of an innovation--the introduction of something new (an idea, method or
device). Fundamentally, there are five stages of the innovation adoption process:
knowledge, persuasion, decision, implementation, and confirmation (Table 4).
Table 4. Phases of Diffusion of Innovation.\textsuperscript{55,132,146}

<table>
<thead>
<tr>
<th>PHASE</th>
<th>PHASE DESCRIPTION/CHARACTERIZATION</th>
</tr>
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<tbody>
<tr>
<td>Knowledge/Awareness</td>
<td>In this stage the individual is first exposed to an innovation but lacks information about the innovation. It should be noted that during this stage of the process the individual has not been inspired to find more information about the innovation.</td>
</tr>
<tr>
<td>Persuasion/Interest</td>
<td>In this stage the individual forms a favorable or unfavorable attitude toward the innovation. Attitudinal beliefs will affect this stage and predispose an individual’s personal assessment of the innovation and whether he/she actively seeks information/detail about the innovation. Rejection can be active or passive. Organization culture and individual ethos play large roles in this stage; both provide pressure for adoption or rejection.</td>
</tr>
<tr>
<td>Decision/Evaluation</td>
<td>In this stage the individual takes the concept of the innovation and weighs the advantages/disadvantages of using the innovation and decides whether to adopt or reject the innovation.</td>
</tr>
<tr>
<td>Implementation/Trial</td>
<td>In this stage the individual employs the innovation to a varying degree depending on the situation. Reinvention (the degree in which an innovation is changed or modified by the user in the process of adoption and implementation) can also occur over time.</td>
</tr>
<tr>
<td>Confirmation/Adoption</td>
<td>In this stage the individual (or any decision-making unit) finalizes their decision to continue using the innovation and may use the innovation to its fullest potential.</td>
</tr>
</tbody>
</table>

Diffusion of innovation is a descriptive representation of a change event covering the complete extent from creation, evaluation, early adoption, and general acceptance on an individual or organizational unit level. Therefore, it is often used as a strategy to achieve planned change or retrospectively analyze a change event.\textsuperscript{148}
Institutionalization

Institutionalization represents the terminal step or potential outcome of the change process itself where the change is internalized or accepted as the new norm or stable worldview. Confirmation, adoption and more recently, Normalization Process Theory are common synonyms for the term institutionalization. Specifically, Normalization Process Theory focuses on the dynamics of implementing, embedding, and integrating some a new complex intervention or innovation and is defined as the embedding of a technique, technology or organizational change as routine practice. The key difference between normalization and institutionalization or adoption (discussed more extensively in the next section) is that it focuses on medical innovation and the conditions of use and behavior of everyday users rather than an innovation’s specific champions or early adopters. Furthermore, it reflects the stability, order and practicability in professional and organizational behavior in healthcare. The concept of normalization represents more flexible theory than diffusion, adaption or institutionalization due to two reasons: 1) The expected complex interventions and advances in medicine and 2) the patient and clinician need for flexibly to configure new practices in ways that can specifically meet local situations and requirements.

The lessons of institutionalization are important as many change efforts are not successful or sustained over time (e.g. the efforts to build capacity and competency in primary care). Acceptance of a set of norms is always preceded by three essential steps: 1) discovery of the new norms, 2) realization and understanding of why they are of value or why they make sense, and 3) an acceptance of the new norm.
Adaptation

Adaptation is a term used almost exclusively within evolutionary (incremental) models of change, which will be discussed in greater detail in the next section. Adaptation represents the phase of a change event where there are modifications or alterations by an individual or organization in response to changing external environmental conditions. Interestingly, the concept of environmental adaptation is rooted in Nightingale’s original observations and philosophies on nursing and is a founding tenet of modern nursing theory related to patient care.

Innovation

Innovation is defined as a new concept, idea, process, product, or procedure within an organization. Ideally, innovation is intentional rather than accidental, not routine, and is aimed at producing benefits. The introduction to the general public of the physician assistant concept within organized medicine (1961-1965) is an example of an innovative solution to the identified shortage of medically trained personnel.

Reform

Reform is defined as a process of improving a concept, idea, process, product, or procedure. All three historical case studies (and most health policy debates) are rooted in this concept of reform.

Key Concepts of Change

To understand organizational change, three questions are fundamental to address: why is an organization changing?; what is changing within an organization?; and how is an
organization accomplishing change? To recognize the why, the forces and sources of change must be understood.\textsuperscript{55,156,157} To determine the what of change, the degree, timing, scale, and focus must be projected and analyzed.\textsuperscript{55,130,131} Finally, to understand the how of change, responsiveness, intentionally, and response time should be classified and comprehended.\textsuperscript{55,158} Lastly, the target of change, referring to the outcomes of the change itself, must be clearly identified to establish a clear goal and objective of the change.\textsuperscript{55}

\textit{Forces and Sources}

All too often, organizations become focused on the what or the how of change, overlooking the most crucial initial step - consideration of the why (and where it originates).\textsuperscript{55,157} Understanding why change is taking place is fundamental to a successful change endeavor. Identification of forces and sources assists in the analysis of the validity and efficacy of change in question.\textsuperscript{55,157} Typically, there are two different sources for change: the external and the internal environment of the organization.\textsuperscript{157} In the evolutionary model of change (discussed more in depth in the next section of the chapter), the external environment provides the major stimulus for change where organizations respond to the feedback from the external environment and change accordingly. In contrast, the stockpile of surplus resources, the willingness of key change agents, team leaders or coalitions to buy in to the change, and presence of transformational leadership, are all noted for originating and inciting change internally.\textsuperscript{55,157} In the case of the Flexner Report and the failed efforts to bring about change in primary care, external forces within the general public (increased need), government (a call for greater accountability), and medical community (increased access to specialized care) were the stimulus for change. The
teleological model of change is an example of an internally driven source of change and is often incited by transformational leadership and change agents within the organization. The evolution of nursing theory was a classic example of an internally driven change (e.g. the desire for greater recognition and professional autonomy).

**Degree**

Once the sources and forces of change have been clarified, the degree of change must be assessed in order to understand and anticipate the various effects across the organization or social system. In general, all change falls within two levels or orders of magnitude: first-order and second-order. First-order change does not involve change to an organization’s core. Rather, it is characterized by minor adjustments or improvements within the current operational paradigm and it is more often implemented at the individual and group levels. Furthermore, it is typified by evolutionary and linear processes, developmental or continuous/on-going efforts, single-loop learning (where current processes, policies and culture are not disrupted) and incremental approaches. Examining the case history examples presented at the beginning of this chapter, we can observe that the development of nursing theory is a first-order change because it fit into the profession’s existing values and structure and was fundamental to the development or evolution of the discipline.

Second-order change is transformational in nature, involving major shifts in the underlying vision, mission, culture, and structure or functioning processes of an organization which are irreversible. Furthermore, second-order change is often precipitated by crisis within the organizational unit and is usually multi-dimensional, multi-
level (e.g. involving changes at the individual, group, and overall organizational level), discontinuous, and involves double-loop learning. An example of successful second-order change is the dramatic shift in standardization criteria for medical education that arose from the Flexner Report which successfully disseminated the Johns Hopkins model of medical education.  

A paradigm shift is a second-order change of the greatest magnitude in which there is a fundamental shift in opinion or attitude that results in a change in approach, belief, or practice. Recent research on the success of second-order change has called into question the frequency of true paradigm shifts, as it is estimated that 90-95 percent of changes undertaken in the name of second-order change do not essentially involve transformational shifts in vision, mission, processes or world-view. It is more likely that term is misappropriated and misused because successful paradigm shifts occur very infrequently. The main limitation of categorizing change efforts based upon degree is that it represents a single moment in the cycle of change. Authors within the organizational theory literature, who view change as an uneven continuum with varying degrees of change emerging at different time points, are beginning to question the utility of such a limited single characterization of change. The punctuated-equilibrium paradigm is reflective of this growing trend, in which organizational change is viewed as a multi-leveled life cycle continuum where there are long periods of stable continuous (first-order) change punctuated by brief periods of revolutionary cataclysmic (second-order) disruption.
**Timing**

Change may be also classified as evolutionary or revolutionary in timing. Revolutionary change is characteristically radical, rapid, and drastic in nature; it significantly departs from an existing organizational mission, strategy, and culture. In contrast, evolutionary change is traditionally seen as a part of a developmental or maturational process of an organization. More recent scholarship in this area describes a punctuated equilibrium change model, in which evolutionary change is interrupted by radical revolutionary departure only to return to a basal rate of change. These observations on timing are not unique to change management theory and can be traced back to the teachings of the Greek historian, Herodotus. Other disciplines, such as social science, physical science, economics, ecology, and even adult development, have also explored similar models of stability and transition. The case history of primary care medicine may be a prime example of punctuated equilibrium where the life history of change is protracted and still evolving.

**Scale**

Change can occur at any level within an organizational system, such as the individual, the group/interpersonal, and the organizational level, with degree often being incorporated into the analysis (Table 5). Regardless of the designated level of change, individual and interpersonal (group) dynamics will almost always be affected.
Table 5. Combined Scale of Organizational Change for Industry/Profession.\textsuperscript{165}

<table>
<thead>
<tr>
<th>LEVEL DESIGNATION</th>
<th>SCALE LEVEL</th>
<th>DEGREE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptation</td>
<td>Individual/Group</td>
<td>First-order</td>
</tr>
<tr>
<td>Metamorphosis</td>
<td>Individual/Group</td>
<td>Second-level</td>
</tr>
<tr>
<td>Evolution</td>
<td>Organizational</td>
<td>First-order</td>
</tr>
<tr>
<td>Revolution</td>
<td>Organizational</td>
<td>Second-order</td>
</tr>
</tbody>
</table>

However, any major shift in organizational culture that comes from either a metamorphic or revolutionary change can be disruptive in nature and upsetting to the individuals affected.\textsuperscript{55,159} Therefore, it is particularly important to pay attention to the organization’s ability to respond/adapt to change.\textsuperscript{55} Forcing change on an unready or unwilling group of individuals can damage any change effort or the organization itself.\textsuperscript{55,159} Consequently, some researchers have advocated uncoupling the order of scale with the dimension of time and allowing the process to play out without a forced timeframe.\textsuperscript{131} The risk of this strategy is the lack of a clear expected time period for change and disruption can lead to organizational fatigue with the change process.

Focus

Focus characterizes the nature and content of organizational change into three main areas: structure, process, and attitude.\textsuperscript{55,166} Structure refers to the organizational hierarchy and the relationships and relative ranks of its parts and positions/jobs and is often depicted as a diagram or organizational chart.\textsuperscript{159} Process refers to the way in which work is carried out and, specifically, a series of actions, operations, or events and how people must interact with one another to bring about the intended result.\textsuperscript{55,167} Finally, attitude is defined as an organized mental position with regard to the change by the individuals affected or more generically, how people feel about working within the existing organizational structure and
processes. Aligning the focus of an organizational change effort with the intended degree and scale is paramount to its success, as not all change foci are equal in impact. For example, a change in attitude will usually result in a change in organizational culture and a chain reaction in the other two areas of change. Otherwise, an isolated change in structure (without a change in attitude/culture) does not really reflect an organizational change and may be dysfunctional or nonproductive. The changes made in primary care medicine education is an example of organizational change with a structural focus without an accompanying cultural shift or attitude change.

**Responsiveness**

Responsiveness refers to the organizational reaction to the stimulus to change. In general, there are three types of response to change: adaptive, generative and denial. The concept of adaptive change is closely related to the phenomenon of causality, where there is a relationship between an event (the source) and a second event (the response) and the second event is a consequence of the first. Adaptive response to change is normally not associated with higher organizational learning, as it is generally reactive in nature. In contrast, a generative change response is ongoing, open to higher organizational learning and risk taking and therefore allows for second-order change to occur more frequently. Examples of adaptive and generative response to change from the case histories included the inability to bring about change within primary care medicine and the transformative change within medical education as a result of the Flexner report. Denial of change is where the organization or individual does not accept or respond to the stimulus resulting in the maintenance of the status quo.
**Intentionality**

Another important aspect of change hinges upon the intentionality of the organization towards the change effort. Planned (sometimes referred to as managed or teleological) change refers to intentional and deliberate modifications of organizational structure, process or attitudes.\textsuperscript{55,159} Planned change is usually data- or theory-driven, has an established sequence of events, course, and timeline, and may emanate from any unit, function or level within an organization.\textsuperscript{159} However, regardless of origin, all planned change requires leadership.\textsuperscript{159} If the planned change is transformational or revolutionary in nature, requiring a significant change in culture, mission, or function of the organization, then the leadership must emanate from the top of the organization.\textsuperscript{159} In contrast, unplanned change is developmental or evolutionary in nature (Table 6).\textsuperscript{159,171}

<table>
<thead>
<tr>
<th>ORDER OF CHANGE/DEGREE DESCRIPTION</th>
<th>CHANGE CATEGORY</th>
</tr>
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<tbody>
<tr>
<td>First-order</td>
<td>Planned</td>
</tr>
<tr>
<td>Second-order</td>
<td>Unplanned</td>
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<tr>
<td></td>
<td>Developmental</td>
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<td></td>
<td>Evolutionary</td>
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<td></td>
<td>Transformational</td>
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<td></td>
<td>Revolutionary</td>
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**Response Time and Participation**

Response time of an organization may be characterized as proactive or reactive.\textsuperscript{55} Whereas all unplanned change is reactive in nature, planned change can be both proactive and reactive depending upon the timing of the response to change.\textsuperscript{55} Traditional wisdom within the field of organizational research attributes significant benefits of proactive change, which can be a sign of a healthy generative organizational environment.\textsuperscript{55,159,169}
Participation in a change event may be active or static, depending upon the type of change being implemented. Active participation involves many individuals whereas static participation involves few individuals or even one person. Generally speaking, larger scale and degrees of change entail active participation of the organization. Conversely, first order or limited change may only necessitate one or more select individuals in the change process.

Target of Change

The target of change is the end product or result of a change event. Examples of change targets include: measures of capacity, production, earnings, processes, creation of new missions, change in organizational culture or individual behavior, and institutionalization of the change process itself. Some target changes are more easily measured and assessed than others. All intended and unintended outcomes must be identified in order to assess the success (or failure) of any change efforts.

Applied Theories and Models of Organizational Change

The purpose of any change model is to describe the processes and outcomes associated with change. The previous sections have discussed various characteristics of the change process (responsiveness, intentionality, response time, participation and change targets). In this section, the six fundamental models of organizational change will be outlined and discussed. It is important to review these various models of organization change in order to understand the “big picture” or global impact of change on the organization. Each model in this section...
approaches change from a different perspective and thus represents a different philosophy of change. In addition, each ideological model emphasizes different components of change but no one model will work for all situations; each bears a different set of assumptions (or limitations). Therefore, the selection of a model(s) should be a deliberate and thoughtful process.

**Typology of Organizational Change Models**

The six major types of recognized organization change models are: evolutionary, teleological, life cycle, dialectical, social cognition, and cultural. In an attempt to answer the question “how does successful change happen within an organization?,” the following variables will be discussed for each model: 1) major characteristics and attributes, 2) key processes, actions or agents/individuals and 3) associated limitations and assumptions.

**Evolutionary**

Evolutionary models view change as a mandatory natural phenomenon with the external environment being the primary source or force for change. In this model, change is merely a dependent variable or reaction/adaptation to circumstances and situations. This assumption implies that evolutionary change is deterministic in nature and that individuals within the organizations undergoing change have only a minor impact on the process itself. As a rule, these models are applicable to and more characteristic of unplanned change events, where successful organizations/individuals react to or manage change.
Key necessary activities for managing change within the evolutionary model include: 1) observational awareness of the external environment, 2) an understanding of the organizational system within which one operates, and 3) the ability to create a new organizational structure based upon one’s understanding of the new principles dictated by the environmental change.\textsuperscript{55,156,159,174,177} Greater than 95% of change is evolutionary, involving minor, first-order individual, group level or organizational shifts to the surrounding environment.\textsuperscript{159} However, despite its dominant contribution to our understanding of the majority of change events, the evolutionary model does have some significant limitations. Specifically, evolutionary models often fail to address issues related to the influence of strategic choice and creativity due to the model’s de-emphasis of individual human agency.\textsuperscript{55} Not surprisingly, as an organization matures and develops a coherent organizational structure, radical (second-order) change becomes more difficult.\textsuperscript{55} Furthermore, evolutionary models are often blind to the fact that organizations are essentially social phenomena with individuals involved in (resistant to and accepting of) the processes of change.\textsuperscript{55}

Rene Dubos’s theory of population ecology is an excellent illustrative example of the interplay between environmental forces and mankind exploring the concepts of co-evolution of disease, indigenous microflora, environmental population, and population growth.\textsuperscript{178} In his book, \textit{Man Adapting}, human adaptation is presented as a dialectic between permanency and change, where the human body both reacts and responds to its surrounding environment.\textsuperscript{178} There is an intentional distinction between reaction and response, where the components of the body react in an unplanned or involuntary manner
to their surrounding environment and the sentient mind responds. The response in this case can either be to the benefit or detriment of the human system, but it does involve voluntary choice, individual expression and creativity.

**Teleological**

Teleological models are often referred to as planned change models, which include the processes of strategic planning, organizational development, and adaptive learning approaches. The two major assumptions associated with teleological models are that 1) organizations are purposeful and adaptive, and 2) change occurs because leaders, change agents and/or influential groups within the organization want it to take place. As such, planned or teleological change is a leader-guided process that is linear and well defined with discrete steps. Its forces and sources are internal in nature with the key aspects of planned change being centered on subjective intentionality. Key activities associated with planned change include strategic planning, formative and summative assessment, incentives and rewards, stakeholder analysis and engagement, leadership, and organizational restructuring and reengineering.

The main driver of change is the organization leader or change agent, whose primary responsibility is to align goals, set expectations, communicate strategies, engage key constituencies, and set up reward systems. Unlike the evolutionary model, strategic choice, creativity and experience are highly coveted characteristics of teleological leadership. The primary outcomes of a teleological change model are new structure or organizing principles. The fundamental teleological principles of organizational
change are based upon individual planned change theory, first introduced in the late 1940s by Kurt Lewin.\textsuperscript{175,188,189} Lewin viewed the social environment as a dynamic field which interactively impacts human consciousness, which is now referred to as field theory.\textsuperscript{175,188,189} Dr. Lewin also developed one of the earliest models of change, which he described in three stages: unfreezing, change, and freezing.\textsuperscript{175,188,189} In the first stage (unfreezing), inertia is overcome and the existing mindset is dismantled via bypassing existing mindsets and frame of references.\textsuperscript{175,188,189} Change occurs in the second stage, which is often accompanied by the confusion, anxiety, and lack of clarity associated with any transition and are ameliorated by organizational transparency and communication.\textsuperscript{175,188,189} The third stage (freezing) occurs when the new ways are adopted and comfort levels are reestablished with the new “normal” frame of reference.\textsuperscript{175,188,189} The similarity to the punctuated equilibrium model, and to Kuhn’s scientific revolution model is evident.

Expanding upon on Lewin’s Change Theory, Lippitt and others focused on the importance of change agents and organizational leadership.\textsuperscript{177} Specifically, Lippitt outlined seven iterative steps of successful planned change: 1) diagnose the problem, 2) assess the motivation and capacity for change, 3) assess the resources and motivation of the change agents (including the change agent’s commitment to change, power, and stamina), 4) establish an action plan and progressive change objects, 5) specify and clarify the role of change agent (i.e. facilitator, expert, mentor, etc.), 6) maintain the change via communication, feedback, and group coordination, and 7) with the change intact and stabilized, gradually terminate the active change process.\textsuperscript{175,177} Over fifty years later, John Kotter reinvented the steps of planned change with a seminal book on organizational
change, Leading Change. Echoing the themes of Lewin and Lippitt, Kotter’s eight stage process is very similar in frame and scope: 1) establish a sense of urgency, 2) create the guiding coalition, 3) develop a vision and strategy, 4) communicate the change in vision, 5) empower employees for broad based action, 6) generate short-term wins, 7) consolidate gains and produce more change, and 8) anchor new approaches in culture.

After review of the above three descriptions of teleological change, it is evident that leaders and change agents are the focus of any planned change. Within this framework, other individuals receive little attention. Current research in planned change has attempted to address the issue of the individual within the organization, by including the impact of collaboration and participatory leadership on teleological models of change. Despite the emphasis of including the individual as a part of the organizational change, it is still the leader (or change agent) that that is responsible for planning, mapping, analyzing, and assessing any change effort.

Advantages of the teleological change model include the clear identification of a leader as a change agent. Although the role of collaboration has been augmented in current iterations of this model of planned change, the main limitation of teleological change is the lack of emphasis of those participating (but not leading) the change process. Furthermore, the importance of organizational culture and social cognition, addressed in the following models, is not sufficiently apparent within most models of planned change. In addition, many organizational change theorists criticize the teleological method for taking an overly rational and linear approach to change, which may not make this model as applicable to second-order change.
Perhaps the most significant limitation is the excessive (and perhaps false) emphasis on a leader’s control of change through creativity, thoughts, decisions and strategy.\textsuperscript{55,159} Organizations, and hence organizational change, often behave irrationally when faced with change, which makes the control of the leadership more illusionary and the leader’s ability to change more attribution than real.\textsuperscript{55,159}

**Life Cycle**

The life cycle model views the individual as a part of the whole organization, both of which go through a process of development and change.\textsuperscript{157,159} Similar to the teleological models, the life cycle theory of change focuses on key individuals or management of an organization playing a major role within the model’s adaptation process.\textsuperscript{157,159} In the life cycle model, organizational change can be described as numerous individuals undergoing a similar change process at the same time.\textsuperscript{55} Each individual makes choices relative to his or her personal situation and the culture that binds the group together.\textsuperscript{157} The term used for this phenomenon within the literature is systematic individual change.\textsuperscript{55,157}

Derived from child development literature, the life cycle model assumes that the individual and the organization are on a tandem development journey which is broken down into stages: birth, growth, maturity, phases of revival, and eventual decline (Table 7).\textsuperscript{55,130} In this model, change is viewed as a natural process of aging and development.\textsuperscript{55,130} The external environment is still a force and source of change, but the life cycle model focuses on the individual and the organization as agents of change.\textsuperscript{55} Processes and activities such as job training, mentoring, and internal communication strategies are viewed as adaptive coping measures to change.\textsuperscript{55,169}
The life cycle model of change differs from both the evolutionary and teleological models in that it emphasizes the role of the individual within the organization (rather than the leadership) as critical to the change process. In this model, change will not occur unless people within the organization are ready and willing to partake in the process. Furthermore, the change process primarily focuses upon assisting the individual in adjusting to the change. Within this model, leaders are deemphasized as change agents and are recast as parental facilitators, assisting adaptation by providing the resources, training, and personal development tools to calm fears during the change process. Limitations of this model include the assumption that the phase of change can be meaningfully impacted through adaptation activities, training, and managerial manipulation. Furthermore, there are several studies which indicate that organizations do not strictly proceed through the stages of biological maturation, but rather follow a more random and variable life course.

<table>
<thead>
<tr>
<th>STAGE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Growth</td>
<td>Models youth and adolescence; emphasis on creativity and learning</td>
</tr>
<tr>
<td>Greatest Efficiency</td>
<td>Models early adulthood; organization has energy, momentum, and highest level of training</td>
</tr>
<tr>
<td>Diseconomies of Scale</td>
<td>Organization grows larger; individuals show less commitment, become embedded in traditions or history, and less productive</td>
</tr>
<tr>
<td>Crisis</td>
<td>Change occurs within the organization</td>
</tr>
<tr>
<td>Cessation of Function or Rebirth</td>
<td>Post change phases where the organization experiences reinvention or death; the change cycle ends</td>
</tr>
</tbody>
</table>
Dialectical

The dialectical model describes organizational scenarios in which two opposing viewpoints coexist within one organization, influencing one another and, over time, inciting change. Within this model, it is assumed that conflict is inherent to human nature and that organizational discord is normal and necessary to growth. Although the process of change is rooted in conflict, the targeted outcome is the emergence of an amended organizational ideology and identity based upon compromise and negotiation. As such, the change processes of the dialectical model include: bargaining, persuasion, influence peddling, and power brokering. Change agents and leaders function as levers, providing a fulcrum or pivot point for change, with the collective individual response to being both the object of change. Progress and rationality are not necessarily a part of this theory of change and dialectic change does not always bring a better reality.

The dialectical model shares assumptions with cultural models, but examines how a dominant culture shapes the organizational process. As such, dialectical models do not assume that all individuals are involved in the change process. Participation in change is closely tied to resources; when resources are plenty, few people worry about engaging in conflict. Likewise, when resources become scarce, people are motivated to engage in dialogue and conflict. Human needs and motivation, particularly in the resource scarce situation drive this model. Here, organizations are perceived as political entities in which dominant culture manipulates its power to preserve the status quo and maintain privilege.

A dialectical change process essentially involves three basic steps: 1) agenda setting, 2) network and coalition building, and 3) bargaining and negotiation. Fundamentally
different from establishing an organizational mission, agenda setting involves listening to constituents involved in the change process, articulating the collective concerns in priority order.\textsuperscript{187} Once the agenda is established, coalitions should be built around key people who will either facilitate or impede the change process.\textsuperscript{187} The primary purpose of developing a network of relationships with key people is identifying the key people within an organization who can overcome or mount a resistance campaign.\textsuperscript{187} Once all the key individuals are identified and engaged, collective bargaining and negotiation can begin to establish the outcome of the change effort.\textsuperscript{187}

The key activities of dialectical change include a consideration of all the viewpoints within an organization, not just the leadership.\textsuperscript{187} Within this model, the change process is deterministic, shaped by collective bargaining and concessions as coalitions form in the struggle for ideological dominance.\textsuperscript{187} In the extreme cases, ideological camps may be unwilling to negotiate or compromise and change will not occur until there is a power shift between the fighting factions. Similar to the life cycle model of change, the focus of the change process is at the individual rather than the leadership or administrative level.\textsuperscript{187} Even though the focus is at the individual level, not all people will be active in the change process.\textsuperscript{187} Generally speaking, people will engage in a change effort if there is a scarcity of resources and a concern regarding limitations of funding or supplies.

The advantage of the dialectical model is the recognition of the inherent chaotic and political nature of change, which is not acknowledged in the evolutionary, teleological and life cycle models. In addition, dialectic change also accepts that not all change is positive and that some may even be detrimental to the individual(s) or the organization.
Limitations of this model include the internal focus of change, which fails to account for external or environmental forces on the political processes of change. Also, this model offers little guidance to organizations or leaders on change.

Social Cognition

The emphasis of the social cognition model is again at the level of the individual and his/her unique perspective of the change processes. In this model, there is no single reality or viewpoint for the organization. Change in this model results from cognitive dissonance, where there is a logical inconsistency between one’s beliefs and a natural drive to reduce or eliminate the discrepancy; everyone has a different perspective of the current organizational landscape and the change process. The social cognition model is built upon the foundation of the life cycle model with expanded examination of organization and individual learning methodology.

Social cognition is an interactive circular model, where change does not occur linearly, but rather as a multifaceted, interconnected, obstacle ridden process. The outcome of a social cognitive process is a new world view or perspective. The role of leadership and change agents within this process is through the framing and interpretation of change and assisting the individual to make sense of the change process. Within this model, change is socially constructed through learning and interpretation with little or no environmental influence on the process. Furthermore, change can only be understood and enacted through individuals.
The focus of the cultural model is the collective and shared phenomenon of organizations. Cultural models blend the social cognition and dialectical methods by focusing on the spirit or unconscious complexity of an organizational structure. Change in this process is slow and entails alterations of symbols, beliefs, myths and rituals. Within this model, it is very important to understand history and traditions within the organization.

Cultural change can be planned or unplanned, regressive or progressive, and can have both intended and unintended outcomes. Although every typology of change has both intended and unintended outcomes, the cultural change model emphasizes both in its outcomes analysis more than the other previously described models. The inclusion of intended and unintended outcomes is explained in part because of the model’s focus on the collective and shared phenomenon of the group that adds complexity (and unpredictability) to the analysis of change. The change processes tend to be nonlinear, irrational, unpredictable, ongoing and dynamic. Paradigm shifts are examples of second order of cultural change, where there are alterations of fundamental belief systems or organizational culture.

Key activities of the cultural model emphasize the collective process of change and the key role of each individual in modifying the mission, as well as creating new organizational rituals and symbols. These models often focus on the leaders’ ability to shape organizational culture via fostering energy, developing enthusiasm, and altering people’s motivation. Limitations of the cultural model include an over-simplification of the concept of culture and the processes of change and the assumptions regarding human
plasticity. Moreover, it is unclear whether one can try to manage people or even create a culture that is supportive of change within an organization. However, despite these limitations, cultural models do account for the context, complexity and contradictions of change, which are important contributions to organizational change theory.

**Models of Change in Higher Education: Examination through the Typology of the Six Models**

In this section, research related to the application of the six models of change to higher education institutions will be reviewed. As outlined above there are distinct differences between the known models of change. Some focus on the “what” or “how” change is actually occurring (i.e. evolutionary models and others derived from actual experience); whereas others concentrate on effective approaches (i.e. teleological models or other idealized or theoretical approaches). Understanding which models best explain the way change is occurring documents current practices. Yet idealized models, even if they may have not been proven effective, offer solutions to problems and may be useful in a change event.

**Applying the Concepts and Models of Change Theory to the VCR Program**

In an effort to better appreciate the systemic change phenomena, social scientists have borrowed concepts, models, metaphors and theories from many other disciplines, ranging from child development to evolutionary biology. The six major types of organizational change reviewed here reveal a diversity of theories regarding change. However, the diversity of theories and concepts borrowed from different disciplines also
often encourages compartmentalization of perspectives and one-dimensional, simplified interpretation of the change process itself.\textsuperscript{148,190} Failure to understand the dualities and interrelatedness of the various typologies of organizational change will ensure a limited understanding of the change processes itself.\textsuperscript{148}

The juxtaposition and interplay between these different theories and perspectives provides for a more complete understanding of organizational change, because any one theoretical perspective invariably offers only a partial account of a complex phenomenon.\textsuperscript{190} Clarifying the relationships between divergent views provides opportunities to develop new theories and models of change that have greater explanatory power than any one single model.\textsuperscript{190} By examining a change event through the different lens of each of the six typologies of change, a complex multifaceted organizational picture emerges.

In the next chapter, I will introduce and describe the VCR program at NCSU CVM. The VCR program is a novel initiative in Public Health training that I have created and initiated in response to my participation in the DrPH Program in Health Leadership at the UNC-CH GSGPH. Through my studies including the review of the fields of organization and paradigm changes reviewed above, I have developed a clear understanding of the benefits of a more comprehensive approach to disaster training and preparedness training within the professional veterinary curriculum. This program is the first of its kind in the United States. The VCR program is intended to train all NCSU professional veterinary students to provide leadership and skills in the event of a disaster, agricultural or otherwise, and represents a
new paradigm in public health training through a veterinary medicine lens and OH perspective.\textsuperscript{7,9,50}

To answer the research problem, “In what way(s) and to what extent does the VCR program orient professional veterinary students towards a more global, comprehensive, inclusive (OH) perspective of Public Health?” and Research Questions 1 and 2 (“What are the key features of the VCR program that orient students towards OH?” and “What is the efficacy of the VCR program in orienting and enabling students towards OH-PH practices?”), I will analyze the program’s mission, goals, processes, implementation strategies, key features, partnerships, and efficacy through the six different types of organizational change. It is expected that each typology of organizational change will provide an alternative picture of the VCR program that will highlight areas of interplay (i.e. mutual benefits and synergistic goals), conflict (i.e. competitive needs and contradictory purposes) and/or omission. Compiled together, these divergent views will provide a comprehensive picture of the change process associated with the VCR program that can be applied to other health professions attempting to introduce an OH (or any new) paradigm into their curriculum.
CHAPTER 3: THE VETERINARY CREDENTIALED RESPONDER PROGRAM

Introduction

Veterinarians play a critical role in caring for animals after natural and man-made disasters. Two recent disasters—Hurricane Katrina and the 2007 wildfires in California—illustrate the necessity of incorporating the welfare of animals in disaster planning to avoid compounding the emotional and economic toll on individuals and communities impacted by devastating loss or injury. Today, in light of the increasing importance of the human-animal bond, emergency response and evacuation planning efforts are increasingly including the needs of animals. For example, as a result of the Pets Evacuation and Transportation Standards (PETS) Act of 2006, all states are required to incorporate the needs of animals and their owners in their disaster planning and preparation. This bill is an amendment to the Stafford Act, a law that provides a cost-sharing mechanism between the federal government and state or local governments during response to and recovery from major disasters. In addition, the PETS Act also allows the FEMA administrator to support such state and local planning processes with grants which provide for expenses related to veterinary services for people with household pets and service animals.
Despite multiple exposures to disasters, US veterinary colleges have not comprehensively incorporated disaster management education within their curricula.\textsuperscript{195} Given the multiple demands on an already broad curriculum, it is not surprising that programmatic emphasis and dwindling college resources are placed on what is traditionally seen to be core clinical and didactic training in veterinary medicine.\textsuperscript{195} However, failure to incorporate key elements of OH into the veterinary curriculum disaster preparedness and management skills needed to work in a cross-disciplinary environment could lead to a profession that is out of touch with societal demands and needs, particularly in the public health and service sectors.\textsuperscript{195-206} It is vital that veterinarians pay attention to the words within their professional oath which calls them to improve animal and human health and welfare by using their scientific knowledge and skills for the benefit of society.\textsuperscript{29} There are few more obvious ways to meet a mandate such as this than to be involved with one’s own community in preparedness and response.

One of the highest priorities identified by the emergency management and disaster preparedness community has been the development of standards and guidelines for the education and training of cross-disciplinary health teams able to respond to major threats to a community’s health and welfare.\textsuperscript{16,207} The need for rapid and effective disaster training of all health professions is now widely recognized and mandated.\textsuperscript{1,15,16,208,209} Developing professional standards and educational programs based on the literature and sound educational theory remains an important gap to be filled. Prior to developing a response to disaster preparedness and emergency management within the veterinary curriculum, it is imperative for academic educators to understand what “disaster training” should entail within today’s veterinary curriculum, including how disaster training is presently being taught within our profession and
how it is approached in other health professions such as human medicine, dentistry, nursing, and public health. To this end, I conducted a literature review to summarize the curricula and training programs relating to disaster medicine in human health professions and veterinary medicine. The purpose of any literature review is to provide a comprehensive picture of the existing published knowledge on a particular topic. In particular, this literature review focused on peer-reviewed articles detailing the curricular content of disaster preparedness training and educational programs in human and veterinary medicine. The results from this literature search aided in the development of a new competency based Veterinary Credential Responder (VCR) program for veterinary students at NCSU-CVM.

**Search Protocol**

As this literature review topic encompasses the diverse disciplines of public health, disaster management, medicine (human and veterinary), and educational programs, PubMed and CAB abstracts were used to identify articles related to the question of interest. Specific search terms utilized were the following MeSH or keywords: Medicine or Veterinary Medicine AND Disaster or Disaster Planning AND Training or Curriculum.

**Literature Eligibility Criteria**

To be eligible for inclusion within this literature review, each article or text had to comprehensively describe the course contents of a disaster management curriculum or training program to be used. An article was considered comprehensive if it thoroughly described the core competencies, objectives and/or content of a curriculum. Review articles or reports describing educational programs/courses/degrees were preferred. Inclusion criteria included
only English-language articles or translated text and only articles published during the previous years (January 2003 to December 2008). The five-year timeframe was chosen because the landscape of emergency management had significantly changed since the events of the Foot and Mouth Virus outbreak in the United Kingdom from February through September 2001, the terrorist attacks of 9/11/2001, the anthrax letters of September/October 2001 and Hurricane Katrina (8/25/2005).

The initial search strategy identified 257 articles that were potentially relevant to the curricular review on disaster and emergency management training within veterinary and medical professional programs (Figure 2). Each abstract was initially reviewed relative to the inclusion criteria and 28 relevant abstracts were identified for full evaluation. Of these 28 articles, only 14 comprehensively described the course contents of a disaster management curriculum or training program in sufficient detail to be evaluated, and thus were thus included in the final literature review. Of the 14 articles, 9 articles were from veterinary medicine and 5 articles were from other related health professions.
Figure 2. Distribution of articles included in the full literature review on disaster preparedness.

Terminology Definitions

The review was conducted based on a broad definition of disaster training to identify as many articles as possible describing various training and educational programs in emergency management available within veterinary medicine, human medicine, dentistry, nursing, or public health programs of study. Consequently, the educational programs varied in objective, scope, and depth from two-day short training courses, self pace distance education seminars, to federally credentialed certification programs. Qualitative measures (descriptive situations or
substance) evaluated included curricula/program description lecture content, and core competencies gained.

For the purposes of this review, an emergency is defined as an unanticipated event that could threaten humans, animals, and/or the environment requiring immediate action.

A disaster is defined as an escalating emergency resulting in significant loss, damage or destruction on a large scale. An emergency can become a disaster if immediate action is not taken.

A curricular program is defined as a series of educational modules or units covering the topic of emergency preparedness and disaster management, each with discrete learning objective(s).

A core competency is defined as a combination of knowledge and skills that are critical to the effective and efficient function of an individual within the emergency management structure related to emergency planning, detection, response, and/or mitigation.\textsuperscript{16}

The Incident Command System (ICS) is a nationally standardized, on-scene, all-hazards organizational structure used to command, control and coordinate the use of resources and personnel that have responded to the scene of an emergency. The foundation of ICS is based upon a flexible, scalable response organization providing a common framework within which people can work together effectively.\textsuperscript{210-212} Therefore, the concepts and principles for ICS include common terminology, modular organization, integrated communication, unified command structure, consolidated action plan, management span of control, designated incident facilities and comprehensive resource management.
One Health is defined as the collaborative effort of multiple disciplines, working locally, nationally, and globally, to attain optimal health, in its restricted sense, for people, animals, and our environment.\(^5\) The principle of optimal health used here is in its most restricted sense and does not hold that what is best for public health will be the best for animal or environmental health (or vice versa) as often the three domains are in conflict.\(^2\)

The United States’ National Incident Management System (NIMS) coordinates emergency preparedness and incident management among various federal, state and local agencies.\(^21\)

The National Response Framework (NRF) is the United States’ national plan to respond to emergencies such as terrorist attacks or natural disasters.\(^213\)

Literature Review Methods

From each selected article or text, the information evaluated included: 1) description of existing course content or educational elements of curricular/educational programs, 2) the presence of degrees/certification and training in professional medical, dental, nursing, public health and veterinary schools, and 3) the skill sets and core competencies deemed necessary to integrate health care professionals into multidisciplinary and discipline-specific work environments. I did not anticipate finding many articles that addressed all of the above within one text.

Literature Review Results

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In general, there are very few articles on competencies and curricula for health–related emergency and terrorism preparedness in the literature. There are several comprehensive articles on training programs specific to health care disciplines, but relatively few presented universal competencies included in the design of training programs.

Fourteen articles met all inclusion criteria. Five of the reports detailed educational and training programs within human medical professional curricula (Table 8). Nine of the reports and commentaries detailed current and suggested educational and training programs within veterinary medicine (Table 9). Most of the educational and training programs were incorporated into curricula after disaster events in response to a perceived need for more training and exposure in preparedness. Thus, curricula changed primarily in response to needs created by disasters.

**Disaster Training Programs in Professional Colleges and Schools of Human Health (Table 8)**

The five articles describing human medicine training programs consistently identified core competencies or learning objectives that were viewed as crucial to emergency preparedness. However, the descriptions of the curricula varied widely in scope, detail, and specificity. Four of these non-veterinary reports focused on core competency-driven, outcome-based, objectives, while the remaining report focused on didactic knowledge-based training.

Most of these studies advocated the need for ICS and NIMS training, in addition to basic skills of teamwork, communication, event management (chain of command, roles and responsibilities), creative problem solving and realization of personal limitations.
Implementation of such programs and methods of instruction were discussed in three of the reports. These varied from short courses of either two days or one week (Appendix 1 and 2), to an integrated curricular approach completed over the four year professional program.
Table 8: Summary of the five articles addressing disaster management training for human medicine in Schools and Colleges of Medicine, Dentistry, Nursing and Public Health.

<table>
<thead>
<tr>
<th>AUTHOR YEAR</th>
<th>TITLE OF ARTICLE</th>
<th>MEASURE OR OBJECTIVE</th>
<th>FINDINGS/RECOMMENDATIONS</th>
</tr>
</thead>
</table>
| Markenson et al 2005 | Preparing health professions students for terrorism, disaster, and public health emergencies: Core competencies | Description of a process and a list of core competencies for teaching emergency preparedness to students in the health care professions | Four basic core competencies were defined for the four health profession schools:  
- Emergency management and preparedness  
- Terrorism and public health emergency preparedness  
- Public health surveillance and response  
- Patient care for disasters, terrorism, and public health emergencies |
| Parrish et al 2005 | A short medical school course on responding to bioterrorism and other disasters | Description of the details of the course, the course evaluation process with regard to changes in students’ knowledge and attitudes, and how the course was improved | The specific objectives of the course were to:  
- Educate students on resources available for regional disaster response  
- Define principles of resource management  
- Identify specific agents that are associated with bioterrorism (chemical, infectious, radiation)  
- Understand the psychosocial aspects of disasters |
| Hsu et al 2006 | Healthcare worker competencies for disaster training | Review of peer-reviewed literature on relevant content areas and educational theory  
- Structured review of existing competencies, national level course and published objectives  
- Synthesis of new cross cutting competencies  
- Expert panel review  
- Refinement of new competencies  
- Development of objective for each competency | Identified core cross-cutting discipline competencies for healthcare workers:  
- Recognize a potential critical event and implement initial actions  
- Apply the principles of critical event management  
- Demonstrate critical event safety principles  
- Understand the institutional emergency operation plan  
- Demonstrate effective critical event communications  
- Understand the ICS and your role in it  
- Demonstrate the knowledge and skills needed to fulfill your role during a critical event |
| More et al 2004 | Predoctoral dental school curriculum for catastrophe preparedness | The article describes the development of a curriculum to prepare dental students to respond to a catastrophic event. This curriculum is based on the collaborative activities of one dental school with partners in organized dentistry, medicine, law enforcement, the military, and the federal government | The following competencies were identified for dental graduates:  
- Describe the potential role of dentists in the first/early response in a range of catastrophic events  
- Describe the chain of command in the national, state, and/or local response to a catastrophic event  
- Demonstrate the likely role of a dentist in an emergency response and participate in a simulation/drift  
- Demonstrate the possible role of a dentist in all communications at the level of a response team, the media, the general public, and patient and family  
- Identify personal limits as a potential responder and sources |
that are available for referral

- Apply problem-solving and flexible thinking to unusual challenges within the dentist’s functional ability and evaluate the effectiveness of the actions that are taken
- Recognize deviations from the norm, such as unusual cancellation patterns, symptoms of seasonal illnesses that occur out the normal season, and employee absences, that may indicate an emergency and describe appropriate action

| Rottman et al17 2005 | Development of a training curriculum for public health preparedness | A review of the role and function of public health professionals and agencies during a disaster | Representative competencies and related training content:
- Describe the public health role in emergency response in a range of emergencies (NIMS (SEMS))
- Describe the chain of command in emergency response (ICS)
- Describe individuals’ functional role in emergency response and demonstrate role in regular drills
- Bioterrorism 101
- Identify limits to own knowledge/skill/authority and identify key system resources for referring matters that exceed these limits
- Recognize unusual events that might indicate an emergency and describe appropriate action
- Apply creative problem solving to unusual challenges and evaluate effectiveness of actions taken

±Proficiency levels assigned to each of the four health care disciplines involved in the project are based on Bloom’s taxonomy.15,218,219 A summary of the content areas and the core competencies can be found in Appendix 3. Each competency category was then broken down into detailed skill sets and assigned a recommended proficiency level, based upon the specific health care discipline’s needs assessment.
Disaster Training Programs in Professional Colleges and Schools of Veterinary Medicine (Table 9)

Within the available veterinary literature I reviewed, only two articles described and discussed curricula related to public health and disaster preparedness.\textsuperscript{32,220} Examination of the literature review revealed that it is common practice within most DVM professional programs to embed portions of disaster preparedness training within the public health course contents curriculum, as the educational objectives of each topic are highly correlated and interwoven.\textsuperscript{32,196,220,221} The practice of embedding disaster training within the public health curriculum makes sense, as the educational objectives of veterinary public health, which include preparing veterinarians for service-oriented careers in animal agriculture, environmental and public health, disease prevention, biosecurity and food safety and security, are similar to the all-hazards emergency management objectives involving people, livestock, and pets.\textsuperscript{48}

The content of the remaining seven articles focused on recommendations for programmatic emphasis and content. Compared to the five articles reviewed on curricula in the human health professions, the veterinary literature appeared to have a higher degree of uniformity in the recommendations offered. The veterinary literature also had a concentrated focus on cataloging core competencies rather than detailing specific didactic lecture content. In similarity with the human health literature, however, four of the articles specifically recommended ICS and NIMS training.\textsuperscript{48,196,206,222} Other areas of emphasis included communication training, personal and business continuity planning, all hazards
emergency training of livestock, pets, and volunteers, and a working knowledge of biosecurity and risk assessment.

Implementation plans and methods of instruction were alluded to but not specifically discussed in any of the nine articles. Two articles cited specific degree and certificate programs in public health that are available at the majority of veterinary colleges, but neither mentioned degree programs specifically focused on disaster response. The remaining seven articles advocated for additional training in these areas and were fairly consistent regarding content. Finally, one article highlighted the need for Psychological First Aid (PFA) training specifically as it pertains to mass herd/flock depopulation, a mainstay of biosecurity and infectious disease control. PFA is an essential skill that has relevance across species and disciplines; this methodology, although effective, can have significant emotional, psychological, and economic ramifications within a community. An expanded derivation of PFA is critical incident stress management (CISM). CISM is more comprehensive in nature and include services and training in on-scene support, demobilization or de-escalation, defusing, debriefing, one-on-one support, significant other/family member defusing/debriefing, line-of-duty death support, referrals and follow-up case management.

Generally speaking, all of the articles discussed the need to build capacity in disaster training, as it is an inherent component in the veterinary profession. However, the reports varied in their programmatic detail, depth, and curricular integration.
Table 9: Summary of the nine articles addressing disaster management training/education in Colleges and Schools of Veterinary Medicine.

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<thead>
<tr>
<th>AUTHOR</th>
<th>TITLE OF ARTICLE</th>
<th>MEASURE OR OBJECTIVE</th>
<th>FINDINGS/RECOMMENDATIONS</th>
</tr>
</thead>
</table>
| Nussbaum et al | The veterinary profession’s duty of care in response to disasters and food animal emergencies | Describes the duties of the veterinary profession                                     | The article recommends:  
  • ICS training  
  • All hazards emergency management of livestock, pets, volunteers, and disease  
  • Personal and business continuity planning  
  • Local, state, national organizational affiliation (Nonprofit/Governmental) |
| Murray et al  | Evaluation of veterinary public practice education programs                        | Description of educational programs available in veterinary public health              | Increased number and opportunities for public health training over the last 5 years; Increased utilization of distance learning |
| Becker et al   | An Epiphany: Recent events highlight the responsibilities, roles, and challenges that veterinarians must embrace in public health | Identified the need to build capacity and skill sets                                  | Need for basic criteria for standard training programs to be established  
  • Need for building capacity oriented toward public health within the profession, and proposed changes in recruitment and admissions |
| Riddle et al   | Training the veterinary public health workforce: A review of educational opportunities in US veterinary schools | Examined the current curricula and programs involving public health, epidemiology and preventive medicine and quantify the amount of student exposure to opportunities related to the practice of public health | Need for more flexible education programs allowing for students to concentrate on the career tract of public health  
  • Need for increased CE related to public health  
  • Need for greater collaboration for schools of public health and medicine for multidisciplinary training |
| Heath         | Education in disaster management in US veterinary schools and colleges            | Focuses on how veterinary colleges and schools can embrace disaster management training within their educational programs | Veterinary Colleges/Schools should provide their students with the following skill sets within the core curriculum:  
  • Education in disaster management  
  • Create skills sets in problem solving, leadership, organization thinking, project management and effective communications related to disasters  
  • Specific courses suggested in: budget management, law/regulations, animal and livestock in disasters, incident command, span of control, management by objective, division of responsibilities, volunteer management and effective communications  
  • Optional: Stage a full scale evacuation exercise for the college/school  
  Post graduate education and CE  
  • All hazard approach  
  • Insurance, business continuity planning, management by objective span of control and delegation |
<p>| Wenzel, et al | Veterinary accreditation and                                                    | Discusses the skills, knowledge and aptitude now                                     | Details 16 core competencies of an accredited veterinarian* |</p>
<table>
<thead>
<tr>
<th>Year</th>
<th>Title</th>
<th>Description</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>some new imperatives for national preparedness</td>
<td>expected of accredited veterinarians according to Homeland Security Presidential Directives (HSPD) 5,7,9,&amp; 10</td>
<td>Additional skill sets needed as first responders:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ICS and NIMS training/exposure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Working knowledge of biosecurity and risk assessment related to biological threats</td>
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<td>• Working and current knowledge of reportable diseases</td>
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<td>• Working knowledge and support for the development of a National Animal Identification System</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>• Communications training</td>
</tr>
<tr>
<td></td>
<td>Wenzel*</td>
<td>Organizational aspects of disaster preparedness and response</td>
<td>Discusses need to understand ICS and NIMS</td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td></td>
<td>Advocates understanding and training in ICS, NIMS, Homeland Security Presidential Directives and the National Response Plan</td>
</tr>
<tr>
<td></td>
<td>Nusbaum et al**</td>
<td>PFA and veterinarians in rural communities undergoing livestock depopulation</td>
<td>Discusses the need for PFA training as a core competency when dealing with depopulation to control pandemics</td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leonardi et al†</td>
<td>Veterinary medicine in disasters</td>
<td>Compares the Veterinary Response in 3 countries (US, Italy, France) and the WHO Report on Future Trends in Veterinary Public Health</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

*See Appendix 4 for the complete competency list for an accredited veterinarian.
†See Appendix 5 for the eight intervention-oriented competencies for PFA for disaster victims
Core Competencies in Public Health

Numerous expert panels have attempted to define the core competencies necessary to achieve an effective public health workforce. As a direct result of these efforts, many professional and academic groups have developed recommendations regarding the curriculum content and structure to teach the skill sets necessary to meet those competencies. In 1998, the Pew Health Professions Commission identified a set of 21 competencies for the successful practice of public health (Appendix 6). Specifically, the Twenty-one Competencies for the Twenty-First Century are intended to represent a set of skills, knowledge, and attitudes necessary for the broad practice of public health. However, because the list only captures the competencies necessary for traditional anthropocentric public health practice, it is merely a starting point for a core competency list for a cross-disciplinary partnership and training which includes the considerations of animals and the environment. Because veterinarians work at the interface of human, animal, and environmental health, they are uniquely positioned to drive a public health paradigm shift which expands the definition of population beyond people to include ecosystems and animals.

In 2001, the Council on Linkages between Academia and Public Health Practice (The Council) also developed a set of core competencies for public health professionals targeted at the mid-level public health professional. The framework of the core competencies consists of eight domains: analytic/assessment skills, policy development and planning skills, communication skills, cultural competency skills, community dimension of practice
skills, public health sciences skills, financial planning and management skills, leadership and systems thinking skills (Appendix 7). Although the eight domain framework was intended in part to help with the design and development of competency-based training and curricula, the competencies do not focus on a cross-disciplinary approach nor do they focus on public health impact of animal or environmental health issues.

In 2004, the Association of Schools of Public Health (ASPH) took the Council’s eight domain framework and modified it into a differentiated set of competencies for a Master of Science degree in Public Health. This list of public health proficiencies is separated into five fundamental areas (health policy and management, environmental health sciences, biostatistics, epidemiology, and social behavioral sciences), with one interdisciplinary/cross-cutting competencies group that includes communication and informatics, diversity and culture, leadership, professionalism, program planning, public health biology and systems thinking. These competencies are not designed to serve as a framework for certain required core courses or for the development of a core curriculum, but they are aimed at providing a baseline overview of the knowledge, skills, and other attributes expected of emerging public health professionals. The ASPH’s integrated approach to education and training is ground breaking in that it is broadly inclusive of all professions and it recognizes a systems-oriented approach to public health which includes environmental and animal health issues.
Discussion

Natural disasters, disease outbreaks, and terrorist events highlight the need for medical and veterinary professionals certified in emergency management and disaster preparedness. Within the United States, health care workers are the second largest workforce behind military professionals.¹⁵ According the most recent data from the Bureau of Labor Statistics, there were nearly 2.6 million registered nurses, 661,400 physicians, 141,900 dentists, and 450,000 public health workers, as well as significant numbers of students enrolled in hundreds of different allied medical professional training programs in 2008.¹⁵,2₃⁰ These numbers likely underestimate the actual prevalence of health professionals due to their focus on employment figures. Approximately 2,800 new veterinarians are trained each year with a total number of licensed veterinarians numbering approximately 90201.²³¹ It is essential for these health professionals (both veterinary and human health related) to be appropriately and adequately prepared to respond to public health and animal emergencies. However, the sparse data available suggest that health professionals do not currently feel competent or knowledgeable in this area, although they would like to be.¹⁵

This literature review suggests that a core competency based program is the preferred method to implement a training program within the human health profession as three of the five articles reviewed identified and defined a set of competencies fundamental to disaster preparation compared to two of the nine veterinary articles. The disparity between the human health and veterinary literature is more likely a reflection of the programmatic maturity within the human health professions, as the veterinary literature
focuses on the need for criteria to be established and the need for training, rather than the core competencies previously established and recognized. Establishing core competencies is a controversial topic because the process of developing them is difficult, and achieving competence is not static or an agreed-upon virtue.

The concept of competency training has no single origin, but can be traced back to the medieval guilds in which apprentices learned skills by working with a master and were awarded credentials when they reached a standard of workmanship associated with and set by the trade. Modern concepts of competency gained popularity in the 1980s in the business sector where it was developed to define those core activities or principles that were crucial to a company’s business survival and job effectiveness. Later, core competencies were developed in an effort to improve the standards of education within schools and colleges. The goal of establishing core competency in this context is to improve the accountability of the educational process and shift the educational focus away from process-oriented measures (e.g. number of procedures performed) to outcome-oriented measures (e.g. how well an individual completed the procedure) of education. More specifically, core competency based curricular plans focus on goals and objectives that are delivered by assigned teaching strategies and assessed with a variety of methods looking at outcomes instead of number of courses completed. An all-hazards training curriculum centered on core competencies rather than specific topic matter ensures a focus on proficiency and cross-discipline capability that is not specific to an event or an emergency.
While this literature review has highlighted significant efforts in the area of emergency management instruction, it does have some limitations. The size of the literature surveyed is small, and the literature available on methods for evaluating disaster planning and emergency management training programs is limited. Also, the literature lacks uniformity regarding content, definitions, description, and format that made some of the comparisons difficult. Veterinary and health care students are a large and diverse population, which presents a further challenge to any newly coordinated curriculum development. Because of these and other complications, systematic and formal evaluations of the current curricular programs addressing emergency management and response have not been published, so it is not known if these various programs are meeting their goals.¹⁵

**HISTORY OF DISASTER TRAINING IN NORTH CAROLINA AND THE VCR PROGRAM DEVELOPMENT**

**The Partnership**

North Carolina has a long history of leadership and excellence in disaster preparedness and animal response. In 1999, flooding from Hurricane Floyd devastated the eastern section of North Carolina, killing more than 3 million animals, mostly poultry and pigs.²³⁵,²³⁶ In the aftermath and recovery effort, North Carolina formed a State Animal Response Team (SART), a public-private partnership that follows procedures from human emergency management in order to more effectively deal with animals in disasters.²³⁵ Subsequently, North Carolina’s SART has emerged as a national model for systematically dealing with animals in disasters.²³⁵ These partnership models provided learning lessons of coordination and collaboration when they were utilized during the catastrophic events of
the 2001 Foot and Mouth Disease outbreak and the 2005 hurricane season. Now SARTs are interagency state organizations dedicated to preparing, planning, responding and recovering during animal emergencies in the United States. SARTs join government agencies with the private resources and personnel to resolve animal issues during disasters. SART programs train participants to facilitate safe, environmentally sound and efficient responses to animal emergencies on the local, county, state and federal levels. The teams are organized under the auspices of state and local emergency management agencies, utilizing ICS principles.

In 2002, a continuing veterinary education module was jointly developed by NCDA, USDA-APHIS and NCSU-CVM veterinarians. The module focused on both broad aspects of emergency response principles and response structures specific to North Carolina. It was delivered to over 300 practitioners and has been incorporated as part of the NCSU public health curriculum.

Through this experience and my studies with the Executive Doctoral Program in Health Leadership (DrPH) in the UNC-CH GSGPH, I have gained a clear awareness of the benefits of collaboration and the importance of leadership through change which I have employed in the implementation and cooperation strategy for the VCR program.

**The Program Implementation Plan**

In order to engage the three organizations in the development of a long-term curriculum to benefit OH oriented disaster preparedness and response in North Carolina, several steps inherent to leadership theory and change management were utilized. Each
organization needed a different level of engagement strategy with supporting tactics. As individual organizations had different perceived benefits and commitments, outreach strategies were tailored to the organization. A review of leadership theory and change management practices provided the basis for action with each organization (Table 10).

**Table 10. Organizational and leadership needs, perceived benefits and risks of collaboration, and change management strategies employed in the VCR program for NCSU CVM, UNC-CH GSGPH, and NCDA C&S.**

<table>
<thead>
<tr>
<th>ORGANIZATIONAL ISSUE</th>
<th>NCSU CVM</th>
<th>UNC—CH GSGPH</th>
<th>NCDAC&amp;S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Need</td>
<td>To provide a competitive curriculum for veterinary professionals and to provide programmatic support for identified OH gaps in veterinary profession</td>
<td>To have increased visibility as public health leader in OH; need for cutting edge partnerships and training programs for public health preparedness and health-related emergency response</td>
<td>To have access to trained veterinary professionals to handle emergency response and a trained workforce to support needed food supply demand and governmental positions</td>
</tr>
<tr>
<td>Perceived Benefits of Collaboration</td>
<td>To be identified as leader in emergency responder training and support of veterinary professional public service engagement</td>
<td>To be identified as leader in disaster preparedness training for public health benefit</td>
<td>To provide trained professionals into the community for response efforts during disasters</td>
</tr>
<tr>
<td>Perceived Risks of Collaboration</td>
<td>Loss of control over curriculum needs and delivery</td>
<td>Lack of visibility for school while perception of large faculty commitment</td>
<td>Lack of control over quality of graduates and questions of whether the program would truly succeed in building capacity</td>
</tr>
<tr>
<td>Leadership Needs</td>
<td>To have clear vision and the ability to persuade others to</td>
<td>To maintain visibility in the process and provide subject</td>
<td>To be the end-game stakeholder and influence programmatic</td>
</tr>
<tr>
<td>Change Management Strategies</td>
<td>To affect curriculum to meet emergency response needs and to be the lead agency to motivate change</td>
<td>To willing/able to collaborate externally</td>
<td>To be willing/able to collaborate externally to build capacity within the public service structure in case of emergency response</td>
</tr>
</tbody>
</table>

As the lead faculty member in the ongoing collaboration, I had to provide the necessary vision, communication and leadership skills to introduce the change into the curriculum and to create partnerships. I also had to utilize the fundamentals of change theory to negotiate the proposed change within the core curriculum and ensure effective facilitation between all parties involved. Outlined below are the necessary leadership skills and change management knowledge I utilized during the ongoing collaboration.

- **Ability to Provide Vision of OH disaster preparedness and response** – Providing a vision, direction and communicating the need for a change in training and curriculum was the first order of business when establishing the collaboration between these three organizations.

- **Ability to See the Whole System** – The influence of human, animal and ecosystem needs on a disaster management situation required the involved individuals to think holistically. The curriculum development through an interdepartmental and inter-species perspective necessitated each individual involved to expand their personal frame of reference.
• **Ability to Disorganize the Organized**238 – Creating new methods within the already prescribed curriculum required the ability to affect existing interdepartmental and course structures while maintaining interdepartmental relationships at NCSU CVM, UNC-CH GSGPH and NCDA&CS.

• **Ability to Challenge the Experts**238 in Public Health and Emergency Management – The majority of individuals recruited for participation will be subject matter experts in a defined area. Ground rules of engagement within the group needed to include challenging the traditional focus of public health and disaster response and preparedness.

• **Generate Short-Term Wins**174 – It is often stated that change management is more effective when short-term wins are experienced by the team. Due to the nature of the training and curriculum program, it was difficult to re-create a natural or man-made disaster that would provide evaluation or feedback such as theoretical change management would create. However, short-term wins for the VCR partners could be experienced through course evaluations, numbers engaged in veterinary public service, and publications.

**The Strategy for Cooperation**

A necessary step to insuring expertise and long-term commitment from all engaged organizations was to develop a guiding coalition of key players from each organization.174 As the lead faculty member, I requested and secured key leadership in each organization to act as subject matter experts to guide decision making and long-term evaluation of the curriculum. Each individual engaged in the process had specific areas of expertise for the
curriculum development process. Individuals were selected based on knowledge of animal response needs, reputation in the field, and proven track record of acting in a cooperative environment.

The VCR Program Description

In the fall of 2007, the NCSU CVM established a VCR program based upon core competencies adapted from the veterinary and human literature, NCDA&CS Emergency Programs Division and North Carolina SART (Tables 11 & 12).
Table 11: Proposed required eight core competencies in disaster preparedness and emergency management for veterinary medicine based upon Bloom’s Cognitive Learning Domain taxonomy.  

<table>
<thead>
<tr>
<th>Core Competency Variable</th>
<th>Expected Level of proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICS and NIMS</td>
<td>Comprehension</td>
</tr>
<tr>
<td>CID or PFA</td>
<td>Demonstrate</td>
</tr>
<tr>
<td>Euthanasia physiology, methodology, and mechanics†</td>
<td>Describe</td>
</tr>
<tr>
<td>Biosecurity</td>
<td>Evaluate</td>
</tr>
<tr>
<td>PPE</td>
<td>Demonstrate</td>
</tr>
<tr>
<td>Hazmat</td>
<td>Knowledge</td>
</tr>
<tr>
<td>All hazard approach to emergency preparedness</td>
<td>Demonstrate or Analyze</td>
</tr>
<tr>
<td>Personal and business continuity training</td>
<td>Demonstrate</td>
</tr>
<tr>
<td>Awareness of the opportunities and need for veterinarians with certified responder training at the local, state and national level</td>
<td>Knowledge</td>
</tr>
</tbody>
</table>

†Additional training in the logistics and performance of euthanasia occurs during the 4th (clinical) year of the curriculum.
### Table 12: Components of the VCR Program at NCSU CVM (Fall 2008/Spring 2008)

<table>
<thead>
<tr>
<th>Course number/Description</th>
<th>Year/ Semester</th>
<th>Program Component</th>
<th>Contact Hours</th>
<th>Specific Curricular Content and structure†</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMC 962 – Animal Welfare, Ethics and Social Responsibility</td>
<td>3rd year/Spring</td>
<td>IS 100a IS 200a IS 700a</td>
<td>9</td>
<td>All students were required to complete IS-100 (ICS), IS-700 (NIMS). This portion of the course was self directed and self paced. Upon completion of each training program and the student completed the online examination. As proof of completion of this training, all students forward the primary instructor the congratulatory e-mail from FEMA.</td>
</tr>
<tr>
<td>VMC 962 – Animal Welfare, Ethics and Social Responsibility</td>
<td>3rd year/Spring</td>
<td>PFA</td>
<td>1.5</td>
<td>Didactic lecture and discussion of mental health needs during traumatic events, including foreign animal disease outbreaks and disasters. Students practiced techniques for assisting people in the immediate aftermath of a disaster which would reduce initial distress and would create and sustain an environment of safety, calm, connectedness to others, self efficacy or empowerment and hopefulness.</td>
</tr>
<tr>
<td>VMC 962 – Animal Welfare, Ethics and Social Responsibility</td>
<td>3rd year/Spring</td>
<td>Euthanasia training</td>
<td>3.5</td>
<td>Didactic lecture and discussion on the psychology of grief, bereavement, and the logistics and methodology of euthanasia for equine, companion and food animals.</td>
</tr>
<tr>
<td>VMC 962 – Animal Welfare, Ethics and Social Responsibility</td>
<td>3rd year/Spring</td>
<td>General Principles and Theory of Emergency Management</td>
<td>2</td>
<td>Didactic lecture on general theory of biosecurity and PPE.</td>
</tr>
<tr>
<td>VMC 962 – Animal Welfare, Ethics and Social Responsibility</td>
<td>3rd year/Spring</td>
<td>PPE</td>
<td>1</td>
<td>Simulated investigation of an infected farm within our poultry teaching facility. All students were instructed to don and doff PPE appropriately in a farm setting a germ city tent was utilized to highlight individual breaks in biosecurity. The class was split into 2 groups of 39 students and the simulation was performed on two separate occasions.</td>
</tr>
<tr>
<td>VMC 962 – Animal Welfare, Ethics and Social Responsibility</td>
<td>3rd year/Spring</td>
<td>Hazmat</td>
<td>1</td>
<td>Didactic lecture on Level 1 Hazmat Awareness Training.</td>
</tr>
<tr>
<td>VMP 958 -Public Health Issues in Veterinary Practice</td>
<td>3rd year/Fall</td>
<td>FAD material/training</td>
<td>3.5</td>
<td>Avian Influenza table top exercise was performed. The class was split into 2 groups of 39 students and exercise was performed on two separate occasions. Animal and human health issues were discussed and various roles that veterinarians might play during an AI and or Pandemic event were explored (students were placed into role playing groups of Food Production Vets, Wildlife Vets, Private Practitioner Vets, and State Ag/Public Health Vets.)</td>
</tr>
<tr>
<td>VMC 964/962/965 – TAU Laboratories (VMP 956)</td>
<td>3rd year/Spring</td>
<td>Scenario Based Disaster and Community Response Exercise Training</td>
<td>2.5</td>
<td>All hazards approach to disasters was discussed and a Hurricane table top exercise was performed. Personal and business continuity planning was emphasized. In addition, the various possible roles and responsibilities of a veterinarian were explored on a local, state and national level. The class was split into 2 groups of 39 students and exercise was performed on two separate occasions.</td>
</tr>
</tbody>
</table>

† Each online course is estimated at 3 hours in duration, to be completed on student’s own time, prior to the end of the preceding semester.
† Unless otherwise noted, the content was delivered to all students one time.
As stated previously, this new program is part of a broad College initiative, in partnership with the NCDA&CS Emergency Programs Division, UNC-CH GSGPH, and NC SART, to provide the training necessary for all veterinary students (beginning with the Class graduating in 2009) to achieve entry-level federal credentials in emergency response. Training within the VCR program is cross-disciplinary and focuses on skill sets and knowledge needed to plan for, and respond to, disasters holistically. With these credentials, all our senior veterinary students and graduates will be able to officially assist emergency responders in the event of a disaster.

Currently, students are required to complete 6 hours of classroom training (Euthanasia, PFA, general principles and theory of emergency management, and Hazmat awareness), 9 hours of online training, and a 4-hour Scenario Based Disaster and Community Response Lab (FAD material/training, scenario based disaster/community response exercise, and PPE training) at the NCSU CVM Teaching Animal Unit (Table 12). To the author’s knowledge, this is the first cooperative program in emergency management and response at a United States veterinary institution that is also a part of the required core academic curriculum.

A Brief Review of Instructional Theory and Bloom’s Taxonomy

A brief review of instructional theory and Bloom’s Taxonomy is important to fully understand the core competencies of the VCR program. Instructional theory is a discipline that focuses on how to structure material for promoting the acquisition and retention of knowledge and skill sets. It is based upon Dr. Benjamin Bloom’s seminal 1956 analysis of
academic learning behaviors entitled *Taxonomy of Educational Objectives: The Classification of Educational Goals.* The taxonomy may be categorized into three interrelated and overlapping learning domains: the cognitive (knowledge), affective (attitude), and psychomotor (skills). Within each of the domains, higher order learning is reliant upon mastery of the prerequisite lower level knowledge, attitude and skills. Incorporation of Bloom’s taxonomy into a curricular plan ensures a focus on all three domains, creating a more effective form of education. The paragraphs below detail each of these three learning domains and their characteristics.

**The Cognitive Domain**

The cognitive learning domain is a measure of a person’s intellectual abilities. Cognitive learning behaviors are characterized by observable and unobservable skills such as comprehending information, organizing ideas, and evaluating information and actions. These skills are arranged into six hierarchical levels, beginning from the simple and building to the most difficult (Table 13). These six categories are arranged on a scale of increasing difficulty, meaning that a learner who is able to perform at the higher levels of the taxonomy is demonstrating a more complex level of cognitive function.
Table 13. Cognitive Learning Domain Hierarchy²⁴⁰

<table>
<thead>
<tr>
<th>SCALE OF DIFFICULTY</th>
<th>HIERARCHY LEVEL</th>
<th>HIERARCHY LEVEL CHARACTERISTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation</td>
<td>Ability to make a judgment about the value of something by comparing it to a known standard</td>
<td></td>
</tr>
<tr>
<td>Synthesis</td>
<td>Ability to combine existing elements in order to create something original</td>
<td></td>
</tr>
<tr>
<td>Analysis</td>
<td>Ability to break content into components and recognize and organize conceptual relationships among them for better understanding</td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>Ability to apply a learned skill or knowledge to a new situation</td>
<td></td>
</tr>
<tr>
<td>Comprehension</td>
<td>Basic level of understanding involving the ability to know what is being communicated in order to make use of the information</td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td>The acquisition of information and the ability to recall information</td>
<td></td>
</tr>
</tbody>
</table>

The Affective Domain

The affective learning domain gauges an individual’s emotions towards learning experiences.²⁴⁰ Affective behaviors are characterized in terms of expressed attitudes, interest, attention, awareness, and values.²⁴⁰ Similar to the cognitive domain, affective behaviors are also formatted into a hierarchical scale, from simplest and building to most complex (Table 14).²⁴⁰

Table 14. Affective Learning Domain Hierarchy²⁴⁰

<table>
<thead>
<tr>
<th>SCALE OF DIFFICULTY</th>
<th>HIERARCHY LEVEL</th>
<th>HIERARCHY LEVEL CHARACTERISTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internalizing values</td>
<td>Actualizing behavior which is controlled by a value system</td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>Ability to prioritize principles or values in order of priority</td>
<td></td>
</tr>
<tr>
<td>Valuing</td>
<td>Assessing the usefulness and worth of the knowledge or skill sets</td>
<td></td>
</tr>
<tr>
<td>Responding to phenomena</td>
<td>Actively participating in the learning process</td>
<td></td>
</tr>
</tbody>
</table>
The Psychomotor Domain

The psychomotor domain is characterized by progressive levels of basic motor skills, coordination, and physical movement (Table 15). These physical behaviors are learned through repetitive practice.

Table 15. Psychomotor Learning Domain Hierarchy

<table>
<thead>
<tr>
<th>SCALE OF DIFFICULTY</th>
<th>HIERARCHY LEVEL</th>
<th>HIERARCHY LEVEL CHARACTERISTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origination</td>
<td>Ability to create new movement patterns unique to the situational context</td>
<td></td>
</tr>
<tr>
<td>Adaptation</td>
<td>Ability to modify motor skills to fit a new situation</td>
<td></td>
</tr>
<tr>
<td>Complex Overt Response</td>
<td>Complex movements are possible with a minimum of wasted effort and a high level of assurance they will be successful.</td>
<td></td>
</tr>
<tr>
<td>Mechanism</td>
<td>Ability to perform a complex motor skill; Responses are habitual with a medium level of assurance and proficiency</td>
<td></td>
</tr>
<tr>
<td>Guided Response</td>
<td>First attempts at a physical skill characterized by trial and error coupled with practice lead to better performance</td>
<td></td>
</tr>
<tr>
<td>Set</td>
<td>Characterized by the mental, physical, and emotional dispositions that make one respond in a certain way to a situation</td>
<td></td>
</tr>
<tr>
<td>Perception</td>
<td>Sensory cues guide motor activity</td>
<td></td>
</tr>
</tbody>
</table>
VCR PROGRAM DESCRIPTION: COURSE COMPONENTS AND CONTENTS

ICS and NIMS

Incident Command training is designed to provide overall incident management and supervisory skills in the event of a disaster or emergency. As described in the definitions section of the dissertation proposal, the Incident Command System (ICS) is a process management tool which is the standard organization system/structure for managing emergency incidents, as it is easily adapted to large or small events and allows for a flexible organization structure. The model ICS curriculum organizes four levels of training:

- IS-100a introduces the Incident Command System (ICS) and provides the foundation for higher level ICS training. This course describes the history, features and principles, and organizational structure of the Incident Command System. It also explains the relationship between ICS and the National Incident Management System (NIMS).

- IS-200a is designed to enable personnel to operate efficiently during an incident or event within the ICS. ICS-200a provides training on and resources for personnel who are likely to assume a field supervisory position within the ICS.

- IS 700a course content introduces and overviews the NIMS. The NIMS provides a consistent nationwide template to enable all government, private sector and nongovernmental organizations to work together during domestic incidents.

As part of the course requirement, all students are required to complete IS-100a, IS-200a and IS 700a level courses through the self-directed, self-paced, on-line training.
programs provided by FEMA, US Department of Homeland Security. Upon completion of each training program, the students take the online examination. After successfully passing the exam they receive an e-mail from FEMA as proof of completion of the training. This level of training prepares the students to function as first line supervisors, single resource leaders, field supervisors or emergency management/response personnel.242-244

Psychological First Aid

It is estimated that 75% of all people will be exposed to some kind of traumatic event in their lifetime and that 80% of those exposed to a critical incident will have some kind of mental, behavioral, or psychological reaction within three weeks post event.245 During a disaster, it is important to provide empathy and support for everyone involved, identify needs of survivors and victims', help victims and responders cope with stressful events, and to decrease the likelihood of significant trauma responses as well as delayed responses.

Psychological First Aid (PFA) is the formalized application of mental and emotional support to victims of disaster and is the mental health equivalent to medical first aid. It is primarily focused on providing support and assistance to psychologically normal people who are responding to an intense, abnormal event.245 More specifically, PFA is designed to create and sustain an environment of safety, calm, connectedness to others, self efficacy or empowerment and hopefulness.246 In the immediate aftermath of a disaster, terrorism, or other impactful event, PFA is intended to reduce the initial distress for children, adolescents, adults and families and is thought to ameliorate long term mental health issues. The suite of skills can be applied to almost any stressful situation.246
Understanding the human-animal bond’s manifestations related to an animal’s function and utility (companion or family member, agricultural commodity, or service role) has enormous practical implications for disaster management. Hurricane Katrina aptly demonstrated that animal owners are more than willing to risk danger to themselves and may not evacuate disaster areas unless they are assured of their animals’ well-being.247 Similarly, grief and loss can occur affecting a single family or an individual with equally devastating effects on a smaller scale. The 2007 California wildfires, outbreaks of natural pandemics of foreign animal disease (FAD), and agroterrorist threats also serve as a reminder of how large numbers of people can have their lives disrupted by events that injure or kill, destroy property, and cause emotional upheaval.248 Regardless, the pain and anguish caused by trauma elicits a natural impulse to help and emphasizes the importance of integrating mental health into disaster preparedness and response.224,245,247-250

The PFA training program at NCSU CVM is currently embedded in a guided group discussion (and is reinforced during tabletop exercises) of a simulated disaster, where the emphasis is placed on low stress, yet thorough group problem solving processes. Once the disaster event is introduced and described, the students receive a forty-five minute didactic lecture on PFA, given by our faculty psychologist. Within this presentation, the concept of PFA is introduced along with a discussion of common stress reactions in both adults and children and the syndrome of compassion fatigue. In the second portion of the program, the students are asked to demonstrate active listening skills, prioritize and respond to human needs, recognize and provide information on mild psychological and behavioral reactions, and recognize and provide information on potentially incapacitating psychological
and behavioral reactions. This portion of the training is completed by the student’s participating in a role-play case study of a family being evacuated from their home due to an incoming hurricane (See example in Figure 3).
Figure 3. PFA Case Study Activity.

Activity: PFA Case Study

This case study contains 3 short exercises that can be completed in approximately 25 minutes.

- Form a small group of 3-5 people.
- Have one person read the background information, the story in Scene 1 and instructions for Exercise 1.
- As a group, discuss your answers to the questions in this exercise. Record the responses in the space provided.
- When you have finished Exercise 1, repeat the process of reading the stories and instructions and discussing your responses for Exercises 2 and 3.

As a credentialed responder or volunteer, you will encounter individuals and families who are experiencing many losses. Read through the story of one family. Keep in mind the types of typical phases of disaster responses experienced by survivors.

Scene 1: The Announcement – The Mother’s Story

The evacuation announcement came in around 10 this morning. My three children (ages 11, 7, and 4) and I will leave our trailer as soon as possible. I can’t believe this is happening to us! I don’t know where to begin to pack! I’m petrified that we won’t be able to get out of here in time. I find myself yelling at the kids to hurry up and grab their stuff fast so we can get to the shelter.

I have no idea where the shelter is located that we are supposed to go to and I’m worried about it. I hope I can get directions from one of the emergency people on the road.

We have to leave our cat at home, because I don’t know where our cat carrier is and I don’t know if animals are allowed at the shelter. The kids are really upset about that! I don’t know what to do.

Exercise 1

Disasters always happen in a context. List at least 3 issues that are of great concern for this mother. (Example: She does not know the location of the shelter.) How is she reacting to each of these concerns? (Example: She is worried and anxious.)

<table>
<thead>
<tr>
<th>Mother’s Issues/Concerns</th>
<th>Mother’s Response to Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 3. PFA Case Study Activity, continued.

Scene 2: On the Road – The Mother’s Story

I don’t want to drive too far. My car is old, and I’m worried about it breaking down. And if this line doesn’t get moving, we are going to run out of gas right here on the highway and then what? I work at the Quick Trip at the corner, and barely make enough to make ends meet. I am worried about losing time from work, which will cost me money.

I find that I am really impatient with my kids and I have a pounding headache. They keep bringing up leaving the cat. I am angry that I am put in this situation. I didn’t want to leave the cat and our stuff behind either. If we had brought a lot of our stuff, I’d have to leave it in the car and it would be stolen.

To top it all off, my middle daughter’s medicine is close to running out. She has asthma and needs to have her inhaler. I wish I could have a drink right now.

Exercise 2

Survivors bring a lot of concerns and issues with them as they come to a shelter. As a credentialed responder or volunteer, you will need to be able to perceive these common responses to disaster and understand that they are often connected to the individual’s context.

Use the Checklist of Typical Disaster Responses on the next page and put a check by the responses you note displayed by the mother in Scenes 1 or 2.

Checklist of Typical Disaster Responses

<table>
<thead>
<tr>
<th>Cognitive</th>
<th>Affective</th>
<th>Behavioral</th>
<th>Physical</th>
<th>Spiritual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distractions</td>
<td>Depression</td>
<td>Clinging</td>
<td>Shock symptoms</td>
<td>Anger at God</td>
</tr>
<tr>
<td>Duration / sequence / time distortion</td>
<td>Anxiety</td>
<td>Isolation (withdrawal)</td>
<td>Insomnia</td>
<td>Questioning of faith</td>
</tr>
<tr>
<td>Declining school or work performance</td>
<td>Numbness</td>
<td>Thrill-seeking behaviors (risk taking)</td>
<td>Loss of appetite</td>
<td>Abrupt desire to change belief systems</td>
</tr>
<tr>
<td>Recurrent intrusive recollections</td>
<td>Constricted affect (lack of range or emotional reactivity)</td>
<td>Re-enactments of the trauma</td>
<td>Headaches</td>
<td></td>
</tr>
<tr>
<td>Flashbacks, nightmares</td>
<td>Guilt, shame</td>
<td>Increased substance abuse (alcohol / drugs)</td>
<td>Muscle weakness</td>
<td></td>
</tr>
<tr>
<td>Confusion, disorientation</td>
<td>Fear, phobia</td>
<td>Hyper-vigilance</td>
<td>Elevated vital signs</td>
<td></td>
</tr>
<tr>
<td>Inability to concentrate</td>
<td>Intolerance of fear response</td>
<td>Elevated startle reflex</td>
<td>Excessively rapid heartbeat</td>
<td></td>
</tr>
<tr>
<td>Difficultly in decision making</td>
<td>Global pessimism</td>
<td>Impulsiveness</td>
<td>Hyperventilation</td>
<td></td>
</tr>
<tr>
<td>Mild guilt</td>
<td>Irritability</td>
<td>Excessive eating</td>
<td>Muscle spasms</td>
<td></td>
</tr>
<tr>
<td>Preoccupation (obsession) with event</td>
<td>Anger</td>
<td>Compensatory sexuality</td>
<td>Sweating caused by mental, not physical factors</td>
<td></td>
</tr>
<tr>
<td>Mood swings</td>
<td>Sleep disturbance</td>
<td>Fatigue/exhaustion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-traumatic stress</td>
<td>Family discord</td>
<td>Indigestion, rashes, vomiting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grief</td>
<td>Crying spells</td>
<td>A “thousand-yard” stare</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 3. PFA Case Study Activity, continued.

Scene 3: The Shelter – The Mother’s Story

We finally arrived at the shelter. It is huge and we had to wait in lines, it seemed, for hours. The paperwork! Who feels like doing paperwork at a time like this?

I was having such a hard time keeping my kids with me while I had to ‘process in’ To make matters worse, people all around me have their animals with them on leashes and in carriers. My children are hysterical and one of my daughters needs to go to the bathroom. Irritating!!!

I also realized that in my haste to get out, I had forgotten some of my important papers. Papers that I need here!! What am I going to do?

I feel tired, overwhelmed, thirsty, and angry. Why do we have to go through all this? Where is God? Life was hard enough back home. This is impossible.

Psychological First Aid Cheat Sheet

<table>
<thead>
<tr>
<th>Preparing to Deliver PFA</th>
<th>Expanded Meaning for Each Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain a calm presence</td>
<td>• Your calmness and clear thinking lead others to do same</td>
</tr>
<tr>
<td></td>
<td>• You are modeling a sense of hope</td>
</tr>
<tr>
<td>Be sensitive to culture and diversity</td>
<td>• Be sensitive to culture and ethnic, religious, racial, and language diversity</td>
</tr>
<tr>
<td></td>
<td>• Beware of your own values and prejudices</td>
</tr>
<tr>
<td></td>
<td>• Get information about the communities being</td>
</tr>
<tr>
<td>Be aware of at-risk populations</td>
<td>At-risk populations (partial list):</td>
</tr>
<tr>
<td></td>
<td>• Children</td>
</tr>
<tr>
<td></td>
<td>• Elderly</td>
</tr>
<tr>
<td></td>
<td>• Mothers with babies or small children</td>
</tr>
<tr>
<td></td>
<td>• Those with medical needs</td>
</tr>
<tr>
<td></td>
<td>• Pregnant women</td>
</tr>
<tr>
<td></td>
<td>• Medically frail adults</td>
</tr>
<tr>
<td>Know the setting:</td>
<td>• Know who is in charge during the time you are assigned to work</td>
</tr>
<tr>
<td>• The services and facilities available</td>
<td>• Orient yourself to the setting:</td>
</tr>
<tr>
<td></td>
<td>• All services provided</td>
</tr>
<tr>
<td>• Who is in charge</td>
<td>• Bathrooms</td>
</tr>
<tr>
<td></td>
<td>• Food and water</td>
</tr>
<tr>
<td></td>
<td>• Etc…</td>
</tr>
<tr>
<td>Provide services:</td>
<td>• You will be using some psychological first aid strategies while you are doing your assigned job</td>
</tr>
<tr>
<td>• Know your job role</td>
<td></td>
</tr>
</tbody>
</table>
Exercise 3 - PFA Intervention

This exercise is intended to explore situations in which PFA should be used. Remain in your small groups. Your objective is to determine what you will say and how you will offer PFA to those individuals described in the scenario above.

<table>
<thead>
<tr>
<th>PFA Action</th>
<th>What you would do or say</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make a connection</td>
<td></td>
</tr>
<tr>
<td>Help people be safe</td>
<td></td>
</tr>
<tr>
<td>Be kind, calm and compassionate</td>
<td></td>
</tr>
<tr>
<td>Meet people’s basic needs</td>
<td></td>
</tr>
<tr>
<td>Listen</td>
<td></td>
</tr>
<tr>
<td>Given reassurance</td>
<td></td>
</tr>
<tr>
<td>Encourage good coping</td>
<td></td>
</tr>
<tr>
<td>Help people connect</td>
<td></td>
</tr>
<tr>
<td>Give accurate and timely information</td>
<td></td>
</tr>
<tr>
<td>Make a referral to Disaster Mental Health</td>
<td></td>
</tr>
<tr>
<td>End the conversation</td>
<td></td>
</tr>
</tbody>
</table>
Psychological First Aid Checklist

- Help people meet basic needs for food and shelter, and obtain emergency medical attention (Safety)
- Provide repeated, simple and accurate information on how to get these basic needs (Safety)
- Listen to people who wish to share their stories and emotions, and remember that there is no right or wrong way to feel (Calm)
- Be friendly and compassionate, even if people are being difficult (Calm)
- Offer accurate information about the disaster or trauma, and the relief efforts underway to help survivors understand the situation (Calm)
- Help people contact friends and loved ones (Connectedness)
- Keep families together. Keep children with parents or other close relatives whenever possible (Connectedness)
- Give practical suggestions that steer people toward helping themselves (Self-Efficacy)
- Engage people in meeting their own needs (Self-Efficacy)
- Find out the types and locations of government and non-government services and direct people to those services that are available (Help)
- When they express fear or worry, remind people (if you know) that more help and services are on the way (Help)

Source: SAMHSA, Psychological First Aid for First Responders: Tips for Emergency and Disaster Response Workers, NMH05-0210

Case Study Acknowledgements

The idea for this case study came from the University of North Carolina’s School of Social Work’s Web-based training, “Disaster Preparedness for Public Health Social Workers – Module 3, On Impact – First Stage.”

The Checklist of Typical Disaster Responses was compiled using:

- Steven M. Crimando’s presentation sponsored by the New Jersey Preparedness Training Consortium, “Psychosocial Aspects of Bioterrorism and Disaster Response for Public Health Professionals,” Module 1, Slides 6-7, “Typical Disaster Response Patterns”
- National Center for Post-Traumatic Stress Disorder’s fact sheet
Euthanasia Physiology, Methodology and Mechanics

Taking an animal’s life is likely one of the most challenging tasks a veterinarian faces, as it can require the expert use of both technical and interpersonal skills.\textsuperscript{251} Despite this fact, surveys of both veterinarians and veterinary students commonly find the respondents feel they have not received adequate training or information on this topic during their professional veterinary curriculum.\textsuperscript{251,252}

Euthanasia is the Greek term which means good or easy (eu) death (thantos).\textsuperscript{253} According to the 2007 AVMA Guidelines on Euthanasia, a good death is characterized by minimal pain and distress on the part of the animal.\textsuperscript{254} As veterinarians, it is our duty and responsibility to ensure that if an animal’s life must be terminated, that the procedure be performed with the highest degree of respect, and with an emphasis on making the death as painless and distress-free as possible.\textsuperscript{254}

Ideally, it is the standard of practice that humane euthanasia should result in rapid loss of consciousness followed by cardiac or respiratory arrest and the ultimate loss of brain function.\textsuperscript{254} Ensuring that the animal loses consciousness prior to cessation of cardiac or respiratory function minimizes distress and anxiety experienced by the.\textsuperscript{254} However, it should be noted that a good or humane death, with the absence of pain and distress, cannot always be achieved, especially in instances of foreign animal disease outbreaks or disaster situations, where massive numbers of animals must be terminated in a short period of time and public health concerns are prioritized over animal welfare concerns.

The unit on euthanasia is based upon 3.5 hours of didactic lecture and discussion (euthanasia is also reviewed again in other courses and during their clinical year rotations).
Topics covered during this portion of the course include: the definition and physiology of death, methodologies and recommended guidelines of death for a variety of species (companion animal, equine, food animal and wild life), the emotional and psychological issues surrounding euthanasia, and an informal expert panel discussion with student questions. Included in the lecture series are discussions devoted to ritual and traditional slaughter methodologies, legal issues dealing with carcass disposal particularly pertaining to wildlife, and depopulation (mass euthanasia) techniques.

**Biosecurity and Personal Protective Equipment (PPE)**

The definition of biosecurity is the protection from biological harm, or more specifically, the protection of the economy, environment, and health of living things from diseases, pests, and bioterrorism. In the field, it embodies all the cumulative measures that can or should be taken to keep disease agents (viruses, bacteria, fungi, protozoa, parasites), from a farm and to prevent the transmission from a farm (by humans, insects, rodents, and wild birds/animals) to neighboring farms. In practice, it involves familiar principles medical professionals employ every day in the operating room or any medical facility. A key component of biosecurity includes PPE. PPE includes all clothing and other work accessories designed to create a barrier against workplace hazards. Examples include safety goggles, blast shields, hard hats, hearing protectors, gloves, respirators, aprons, and work boots.

The 3 hour unit on Biosecurity and PPE includes an introductory lecture and video on PPE. The students assemble their own PPE kits, specific for visiting a farm with a zoonotic disease outbreak (see Table 16). The students are then taken to our poultry teaching facility
for a simulated investigation of an infected farm (Image 1). All students are expected to appropriately don their PPE; handle, examine, and collect samples from “infected” rubber chickens; and then doff their PPE without contaminating themselves (Image 2). Ultraviolet detectable powder is used to “infect” the rubber chickens to provide an authentic learning experience and to simulate a disease outbreak. This permits students to experience firsthand the importance and function of PPE, as well as to test whether they succeeded by a faculty member using a hand-held ultraviolet light (UV light) on the student after removing the PPE and exiting the farm (Image 3).

**Table 16. Student PPE Kits Contents**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ziploc bag</td>
<td>1</td>
</tr>
<tr>
<td>Head gear/ Disposable Bouffant Caps</td>
<td>1</td>
</tr>
<tr>
<td>Disposable tie-on masks</td>
<td>1</td>
</tr>
<tr>
<td>Tyvek® hooded protective coverall</td>
<td>1</td>
</tr>
<tr>
<td>Disposable exam gloves</td>
<td>4 (2 pair)</td>
</tr>
<tr>
<td>Disposable plastic boot covers</td>
<td>4 (2 pair)</td>
</tr>
</tbody>
</table>
Image 1. Students in the Poultry Facility discussing Biosecurity and PPE.
Image 2. Donning and Doffing PPE.
Hazmat

A hazardous material may be defined as any item or agent (biological, chemical, physical or radiological) which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. This one hour introductory lecture is designed to provide the class with an ‘awareness level’ understanding of [1] what hazardous materials are and the risks associated with them in a Hazmat incident, [2] the ability to recognize the presence of hazardous materials in an emergency, [3] how to take defensive action and make appropriate notifications to the
appropriate authorities, and [4] what pertinent information to communicate in the event of a hazmat incident.

**All Hazard Approach to Emergency Preparedness**

The students participate in facilitated group discussions involving two simulated disaster events: a zoonotic avian influenza outbreak and a hurricane. Both animal and human health issues are addressed during these two sessions and students are encouraged to assume one of four different roles during the exercise (individual, private practitioner, county level or state/public health professionals). An “all hazards” or systems approach to disasters is emphasized and both personal and business continuity planning are explored. Students are required to complete both a personal and business continuity plan prior to the exercise [see next section]. Both exercises explore the various possible roles and responsibilities of a veterinarian during different types of disasters at the local, state and national level.

**Personal and Business Continuity Planning**

To demonstrate their in-depth comprehension of all-hazard preparedness and disaster planning, the students are required to complete both a personal and professional or business disaster plan prior to the completion of the credentialing program. The student’s personal preparedness plans focus on preparing equipment and procedures for use when a disaster occurs. Their preparedness measures take many forms including evacuation plans and supplies for immediate family and pets, first aid kit contents for people and pets, creation of back-up life-line services (e.g. power, water, sewage), and
rehearsing evacuation plans. The student’s business continuity planning involve preparation for keeping all aspects of a business functioning (e.g. a veterinary hospital or clinic) in the midst of crisis or disaster situation. Both plans are important for health professionals as pre-planning is necessary for preparing for a disaster at home, as well as responding to a disaster within one’s own region or in another part of the country. These plans are evaluated by one or more of the VCR instructors who made suggestions for expansion and improvements.
CHAPTER 4: MATERIALS AND METHODS

Study Design

The goal of this research project is to ascertain whether novel thinking/skills (strongly related to OH) can be successfully instilled in student through a disaster training program at a college of veterinary medicine. As documented in Chapter 1, both medicine (human and veterinary) and public health are in need of a change in focus or a shift in perspective to fully address the scope and depth of modern public health problems, particularly in the area of emergency management instruction.10

Change, however, as discussed in Chapter 2, is difficult and complex. Many factors beyond programmatic content and execution affect the level of impact the program can have on the veterinary profession. Such factors include the broader social, economic and political context in which the planning and programmatic designs were anchored. Additional factors related to the program itself include the quality of the collaborative partnership between the three main contributors: NCSU CVM, NCDA&CS and UNC-CH GSGPH; the quality and expertise of the program faculty and staff; funding and support of the program; and the interest and participation of the students/participants. Combined, these factors determine the quality and depth of instruction and training, which influence the students' knowledge, perceived skill and confidence level, general perceptions regarding the utility and need for disaster preparedness and training, and ultimately their
willingness to consider alternative professional and leadership opportunities in public health and service.

Chapter 3 introduced and described the VCR program at NCSU CVM, which was created and initiated in response to my participation in the DrPH Program in Health Leadership at the UNC-CH GSGPH. The VCR program is an example of the implementation of OH and the collaborative effort of multiple disciplines to obtain best possible health of people, animals and the environment in many ways (realizing, of course, that this does not in any way imply equivalent or optimum health for all). Training through the VCR program provides veterinary students with fundamental skills to be effective leaders in crisis situations. It provides formal communication training and a working knowledge of the mental and emotional support needed by the victims of disaster through the PFA training.

Furthermore, the VCR program demonstrates how interagency and community collaboration in a disaster situation will create a more resilient, strong, and effective emergency management program. For example, through separate facilitated group discussions involving two simulated disaster events, student are exposed to concepts of the importance of providing community leadership as veterinarians and also as health professionals. In addition, through the completion of their personal and business continuity planning, they realize their responsibilities towards their families and communities to provide for the health of people, animals and the surrounding environment.

Situating OH disaster training during the formative years of professional training allows students to carefully and thoroughly consider the civic and professional responsibilities of their personal and professional lives, prepare leaders for the state, nation
and the world, and quickly build capacity in disaster and emergency management. If the VCR program is a truly effective model of OH disaster and emergency management training, then capacity and leadership in OH preparedness will increase. Based upon the stated goals of this research study, the null and alternative hypotheses are as follows:

**Dissertation Hypothesis Testing**

In order to test the hypotheses for this research project, I have designed and executed the NCSU VCR program in 2007, which is a multi-disciplinary curriculum addressing core competencies adapted from health and disaster response literature. Through the evaluation of this program, I will answer the research problem that guides this study: “In what way(s) and to what extent does the VCR program orient professional veterinary students towards a more global, comprehensive, and inclusive (OH) perspective of Public Health (PH)?” In order to fully answer the research problem and assess how the VCR program orients students towards OH, the following research questions were developed:

- **Research Question 1:** What works: What are the key features of the VCR program that orient students towards OH?

- **Research Question 2:** How well does it work: What is the efficacy of the VCR program in orienting and enabling students towards OH-PH practices?
• **Research Question 3:** How can it be measured: What are the reported impacts of the VCR program on disaster preparedness?

The interactional relationship between the dissertation hypothesis testing steps and VCR program evaluation is shown in Figure 4.

Figure 4. **Interactional relationship between the dissertation hypothesis testing steps and VCR program evaluation.**

**Dissertation hypothesis testing steps:**

- **H₀:** Novel thinking/skills (strongly related to OH) can be successfully instilled in students through a single credentialing program.
- **Hₐ:** Novel thinking/skills can not be instilled through a single credentialing program

Test the hypothesis by running and evaluating the VCR program

To answer the research problem, “How does the VCR Program orient DVM students towards OH?”

**VCR program evaluation:**

- DVM Skills are needed for OH
- Teach the students (VCR Program)
- DVM students are prepared
- DVM Students are oriented to OH
The methods and how they will be employed to answer the research question are explained in detail below and summarized in Table 17.
<table>
<thead>
<tr>
<th>RESEARCH QUESTIONS</th>
<th>DATA COLLECTION METHODS</th>
<th>AUDIENCE OR PARTICIPANTS</th>
<th>TYPE OF DATA</th>
<th>ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What works: What are the key features of the VCR program that orient students</td>
<td>1. Literature review on disaster training within other health professions (medicine,</td>
<td>1. N/A</td>
<td>1. Secondary</td>
<td>1,2,3. Comparative qualitative analysis of the VCR program's</td>
</tr>
<tr>
<td>towards OH?</td>
<td>nursing and dentistry)</td>
<td></td>
<td></td>
<td>organizational change using the six different types of</td>
</tr>
<tr>
<td></td>
<td>2. Qualitative description the VCR program’s mission, goals, processes, implementation</td>
<td>2. N/A</td>
<td>2. Primary</td>
<td>organizational change. Evaluation combines qualitative, ranking, and</td>
</tr>
<tr>
<td></td>
<td>strategies, key features, partnerships, and efficacy</td>
<td></td>
<td></td>
<td>frequency analyses</td>
</tr>
<tr>
<td></td>
<td>1. Literature review of change theory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. A detailed description of the VCR program case history including formative and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>summative feedback on the programs efficacy (see Research Question 2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. An evaluation of the four case histories of paradigm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What are the key characteristics of a successful (and unsuccessful) educational</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>change effort historically and how does the VCR program compare?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| 1,2,3. Comparative qualitative analysis of paradigm change between the VCR        |                                                                                         |                          |                |                                                                          |</p>
<table>
<thead>
<tr>
<th>change within the health professions</th>
</tr>
</thead>
</table>

2. How well does it work: What is the efficacy of the VCR Program in orienting and enabling students towards OH-PH practices?

<table>
<thead>
<tr>
<th>Did the VCR curriculum provide the students with the information and skill sets necessary to achieve the expected level of competency and knowledge for the eight identified core competencies?</th>
<th>1. A pre and post knowledge test for the following three core competencies: PFA, Hazardous Materials, and Biosecurity and PPE (data available for 2009)</th>
<th>1, 2. VCR Training participants</th>
<th>1, 2. Primary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. A self-evaluation of their skills, confidence level and perspectives in the defined set of core competencies (data available for 2009, 2010)</td>
<td>1, 2. Descriptive statistics for each training</td>
<td>1. The numbers of PFA, Hazardous Materials, Biosecurity and PPE questions answered correctly will be summed for a total knowledge score on both the pre- and post-knowledge test. The mean, median, and range for each test will be reported. T-tests and Chi Square statistics will be used to determine differences between groups on pre- and post-test scores on PFA, Hazardous Materials and Biosecurity and PPE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. For the self-evaluations of skill, confidence, and perspective, and the formal course evaluation, each category of responses will be summed to create a score for a group of</td>
<td>120 participants</td>
</tr>
<tr>
<td>Did the students value the training program and was the curriculum relevant to the students and their professional goals?</td>
<td>1. Qualitative data will be collected after each module/unit via email query, in which the instructors will seek informal input, assessment, and comments from the students and participating faculty</td>
<td>1, 2. VCR Training participants</td>
<td>1. Data will be scanned and coded for themes, categories, patterns and relations associated with the VCR program. 2. Focused on content, relevancy, process, context, and pace. In addition, these data will be augmented by qualitative data collected after each module/unit, in which the instructors will seek informal input, assessment, and comments from the students and participating faculty</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Did the VCR program achieve its goals of improving capacity in Veterinary Public</td>
<td>1. VCR program statistics: student numbers, demographics, and profiles.</td>
<td>1. VCR Training participants</td>
<td>1. Primary</td>
</tr>
<tr>
<td>Health?</td>
<td>1. Qualitatively describe the initial implementation effort and challenges</td>
<td>1, 2. VCR program participants and faculty that implemented the project</td>
<td>1, 2. Primary</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Did the VCR program alter the paradigm in disaster preparedness and public health training?</td>
<td>2. Report on the status of outcomes identified in the Logic Model (Table 16) by collecting data and evidence of VCR program objectives.</td>
<td>1, 2. Primary</td>
<td></td>
</tr>
</tbody>
</table>

1. **Major findings and lessons learned will be qualitatively described**
2. Status of the VCR program outcomes will be articulated with a review/comparative analysis of the literature related to implementing change

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3. **How can it be measured: What are the reported impacts of the VCR program on disaster preparedness?**

<table>
<thead>
<tr>
<th>Does the implementation and dissemination of the VCR program support the long term application of the OH concept of public health, in addition to developing new awareness, interest and leadership in the Veterinary Public Health profession?</th>
<th>1. Student enrollment in NCServ (the online registration system for medical and health responders in the state of North Carolina)</th>
<th>1, 2. VCR Training participants and Faculty</th>
<th>1, 2. Primary</th>
</tr>
</thead>
</table>

1. **Descriptive statistics**
To answer the primary research problem, (“In what way(s) and to what extent does the VCR program orient professional veterinary students towards a more global, comprehensive, inclusive (OH) perspective of Public Health?”), plus Research Question 1 (“What are the key features of the VCR program that orient students towards OH?”) and a portion of Question 2 (“What is the efficacy of the VCR program in orienting and enabling students towards OH-PH practices?”), I will analyze the program’s mission, goals, processes, implementation strategies, key features, partnerships, and efficacy through the six different types of organizational change. It is expected that each type of organizational change will provide an alternative picture of the VCR program which will highlight areas of interplay (i.e. mutual benefits and synergistic goals), conflict (i.e. competitive needs and contradictory purposes) and/or omission. Compiled together, using inquiry-guided learning and data analysis, these divergent views will provide a comprehensive picture of the change process associated with the VCR program. Evaluation of these data will combine qualitative, ranking, and frequency analyses.

**VCR Program Evaluation**

The remainder of the answer to Research Question 2 will come from formal participant and faculty evaluations of the VCR program. This evaluation is considered both formative and summative in nature as it seeks to provide information for program improvement and to assist other professional programs in making judgments about program adoption or expansion within their own veterinary curricula. Specifically, the program evaluation is designed to provide formative feedback on project design and utility.
that is intended to inform program refinement—however, this dissertation will focus on the elements that tie OH principles to the training program. In addition, the assessment is intended to describe the initial implementation effort and challenges, and to monitor the status of outcomes identified in the Program and Evaluation Logic Model (Table 18) by collecting data and evidence of VCR program objectives. The program’s logic model illustrates how the implementation and dissemination of the VCR program might support the long term application of the “One Health” concept of public health, in addition to developing new awareness, interest and leadership within the Veterinary Public Health profession.
Table 18. Programmatic and Evaluation Logic Model.

**Inputs**
- Funding: Internal funding from Academic Affairs (Dean's office)
- Physical, logistical, and political resources:
  - Curricular and physical space for successful programmatic execution
  - Administrative coordination across courses and disciplines
  - Administrative approval and programmatic backing
- Internal human resources:
  - Faculty
  - Course participants
  - Veterinary Student Public Health Core

**Activities**
- Programmatic planning, development, and implementation:
  - Core competencies defined
  - Curricular content developed
  - Program administered
- Personal and professional disaster plans created by VCR participants

**Outputs**
- New understanding, tools, and curriculum:
  - Development of education and training materials
  - Proposed set of core competencies for training in Disaster Preparedness within professional Veterinary Medical education
  - Model of a successfully executed program in disaster training and preparedness involving multiple agencies and disciplines
- Credentials:
  - All NCSU CVM veterinary students graduating with a Veterinary Certified Responder Certificate

**Internal Evaluation**
- Programmatic evaluation:
  - Pre and post knowledge tests for PFA, Hazmat, PPE and Biowork
  - Self-evaluation of skills, confidence level, and perspectives in the defined set of core competency
  - Informal assessment and evaluation
  - Discussion of the specific procedure re-making this educational change happen (my story)

**Programmatic and Evaluation Logic Model**
- Programmatic assessment:
  - Evaluation of student disaster plans results/thematic analysis
  - End of program formal survey/evaluation
  - Lessons learned

**External Evaluation**
- Programmatic statistics:
  - Numbers trained
  - SurvNC # enrollment
  - Success stories

**Impacts**
- Increased interest and awareness in public service and health within the veterinary profession
- Wider application of the OH concept in public health, veterinary medicine, and emergency management
- Improved leadership skills developed within the veterinary profession in the area of public health and disaster preparedness

**Graduation**
Specifically, the evaluation of the VCR program will be guided by the following questions:

1. Did the VCR curriculum provide the students with the information and skill sets necessary to achieve the expected level of competency and knowledge for the eight identified core competencies?

2. Did the students value the training program and was the curriculum relevant to the students and their professional goals?

3. Did the VCR program achieve its goals of improving capacity in Veterinary Public Health?

4. Did the VCR program alter the paradigm in disaster preparedness and public health training?

In addition, several ancillary methods will be used to gather the data required to answer the above four questions. All students will be requested to complete the following:

1. A pre and post knowledge test for the following three core competencies: PFA, Hazardous Materials, and Biosecurity and PPE (Figures 5, 6, and 7, respectively).

2. A self-evaluation of their skills, confidence level and perspectives in the defined set of core competencies (Figure 9). Questions regarding learner comfort and skill level with each core competency in the program use a standard 6-point modified Likert scale with “strongly agree,” “agree,” “sort of yes/sort of no,” “disagree,” “strongly disagree,” and “don’t know.”

3. An end of program formal course evaluation that included queries focused on content, relevancy, process, context, and pace (Figure 10).
In addition, these data will be augmented by qualitative data collected after each module/unit, in which the instructors will seek informal input, assessment, and comments from the students and participating faculty.

The numbers of PFA, Hazardous Materials, Biosecurity and PPE questions answered correctly will be summed for a total knowledge score on both the pre- and post- knowledge test. The mean, median, and range for each test will be reported. T-tests and Chi Square statistics will be used to determine differences between groups on pre- and post-test scores on PFA, Hazardous Materials and Biosecurity and PPE. For the self-evaluations of skill, confidence, and perspective, and the formal course evaluation, each category of responses will be summed to create a score for a group of responses. Each response will then be depicted in bar charts and the central tendency will be summarized by the mean (ordinal) and mode. Finally, the qualitative data gathered in both the formal and informal evaluative processes will be compiled and used to identify common themes and issues associated with the VCR program.

The answer to Research Question 3, “What are the reported impacts of the VCR program on disaster preparedness?” will only be partially addressed from a short term standpoint. Data collected will be student enrollment in NCServ, the online registration system for medical and health responders in the state of North Carolina, and evaluation of personal and professional disaster plans.

Data will be analyzed using both NVIVO-9 and Excel software packages for qualitative and quantitative analysis, respectively. Finally, Institutional Review Board (IRB)
was sought and acquired for analysis of the data from NCSU and UNC-CH. All data collected will be a part of the normal procedures for student assessment and course evaluation.
Figure 5. PFA Pre/Post Knowledge Test.

<table>
<thead>
<tr>
<th>Psychological First Aid (PFA)</th>
<th>Pre/Post-Test</th>
<th>VMC 962 - Spr 09</th>
</tr>
</thead>
</table>

Name: ______________________

Read each statement and check all the correct responses.

1. Normal reactions to disasters can be grouped into the following types of consequences:
   - a. Behavioral
   - b. Cognitive
   - c. Emotional
   - d. Physical
   - e. Spiritual

2. The problematic serious mental health responses that may occur weeks or months following a disaster include:
   - a. Post-traumatic stress disorder
   - b. General anxiety disorder
   - c. Hyperactivity
   - d. Substance abuse
   - e. Severe depression

3. Communities and individuals that have experienced a disaster are better able to recover if:
   - a. They are resilient
   - b. They are able to plan and execute decisive action
   - c. They tend to be very dependent on the outside resources offered
   - d. They use substances to help them forget
   - e. They express painful emotions appropriately

4. Some examples of typical disaster responses include:
   - a. Headaches
   - b. Distractibility
   - c. Thrill seeking behaviors
   - d. Numbness
   - e. Guilt or shame

5. Factors that can make an event more traumatic include:
   - a. It is anticipated, so there is more emotional build-up to the event
   - b. The cause is unknown
   - c. The event impacts a small area in which people are likely to know each other
   - d. The event involves animals
   - e. The event lasts a long time

6. When using Psychological First Aid, first responders should do the following:
   - a. Help survivors meet basic needs for food and medical attention
   - b. Be calm and listen
   - c. Assist survivors to connect with loved ones
   - d. Provide access to legal aid
   - e. Encourage people to meet their own needs
### Psychological First Aid (PFA) Pre/Post-Test

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
</table>
| 7. When offering Psychological First Aid, the types of things you should not do are:  
   a. Force people to share their stories with you                          
   b. Reassure people by telling them you know everything will be OK         
   c. Establish an ongoing relationship                                      
   d. Make promises that are hopeful but you probably cannot keep           
   e. Criticize existing services when you believe they are not adequate    |
| 8. When working with a survivor, you would make a referral for additional services for the following reasons:  
   a. You think they could benefit from additional services                
   b. The person is suspected of child abuse                               
   c. The person seems socially isolated                                   
   d. The person suggests that they may harm themselves                    
   e. You do not feel like your training is adequate to deal with this person |
| 9. The best way to manage a survivor who exhibits intense emotions includes to:  
   a. Communicate warmth                                                   
   b. Hold your ground and do not back down                                
   c. Come to an agreement about something                                 
   d. Use "please" and "thank you"                                         
   e. Use only concrete, simple questions                                  |
| 10. When using Psychological First Aid, you are fostering a survivor's ability to do the following:  
    a. Regulate their emotions                                              
    b. Continue task-oriented activities                                  
    c. Sustain a positive sense of self-value                              
    d. Maintain and enjoy interpersonal contact with others                
    e. Rely on others to do things for them                                 |
Figure 6. Hazardous Material Pre/Post Knowledge Test.

<table>
<thead>
<tr>
<th>Hazardous Materials</th>
<th>Pre/Post-Test</th>
<th>VMC 962 - Spr 09</th>
</tr>
</thead>
</table>

Name: ___________________

Read each statement and check all the correct responses.

1. A hazardous material may be defined as:
   a. Substances that may be hazardous to health
   b. Solid or liquid materials involving or exposing one to risk of loss or harm
   c. Materials considered dangerous to people or the environment
   d. Substances that pose a potential risk to life, health, or property if released
   e. Only substances that can spontaneous combust or explode

2. Hazmat incidents are unique incidents because:
   a. They require specialized protective measures and certifications not normally available to first responders
   b. They demand a different operational approach
   c. The actions you are expected to take should be in Standard Operating Procedure format.
   d. One should NEVER exceed your level of training and protection
   e. They involve special personal protective equipment

3. The response goals for Hazmat “Awareness” level include:
   a. Clean up
   b. Recognition
   c. Isolation
   d. Protection
   e. Notification

4. Key Defensive Actions for a Hazmat incident include:
   a. Approach and Remain UPWIND
   b. Secure the Scene - Check for Ignition Sources
   c. Identify... From a Distance (Binoculars)
   d. Collect samples for forensic evidence and identification of the material
   e. Communicate Information to Dispatch or 911

5. Key things to communicate when dealing with a Hazardous Material
   a. Specific scene location
   b. Shipping paper information and shipper or carrier name
   c. Placards Information and description of container shape
   d. Presence of injuries, fire, or exposures
   e. Current weather conditions

6. The risk level of injury is the highest when one can ______ the hazardous material
   a. Taste
   b. Touch
   c. Smell
   d. See
   e. Hear
Figure 7. Biosecurity and PPE Pre/Post Knowledge Test.

| Biosecurity and Personal Protective Equipment (PPE) Pre-Test | VMC 963 - Spr 09 |

Name: ___________________________

Read each statement and check all the correct responses.

1. Which of the following statements regarding the principles of Biosecurity and PPE are true?
   The proper practice of Biosecurity and PPE will:
   ___ a. Protect the farm or facility from external biohazards.
   ___ b. Protect the animals and humans from infectious disease
   ___ c. Protect the veterinarian from infectious and zoonotic disease
   ___ d. Protect the veterinarian from acting as a fomite
   ___ e. Protect your equipment and the next farm/facility you visit.

2. Potential situations for the use of the principles of Biosecurity and PPE are limited to the following:
   ___ a. Everyday use of biosecurity precautions for farm and clinic
   ___ b. Disease events from the routine (Upper Respiratory Infections at the Animal Shelter) to Foreign Animal Diseases
   ___ c. Automobile wrecks
   ___ d. Floods
   ___ e. Hazardous material event

3. True or False: A PPE level “D” involving Foot and Mouth Disease (FMD) requires no real specific protection, only common work clothes, coveralls, steel toe boots and safety glasses.

4. Routine biosecurity for Farm trips/isolation wards/surgery suites involves the following measures:
   ___ a. Establishing hot, warm, and cold zones
   ___ b. Protocol for entry & exit (who/what and how)
   ___ c. Appropriate attire-depends really on where going next and are you at risk!?!
   ___ d. What to do with exposed material - syringes, trash, PPE, tissues etc.
   ___ e. Shower or not?

5. Biosecurity planning for Natural disasters include considering the following measures:
   ___ a. Establishing hot, warm, and cold zones
   ___ b. Protocol for entry & exit (who/what and how)
   ___ c. Appropriate attire-depends really on where going next and are you at risk !?!
   ___ d. What to do with exposed material- syringes, trash, PPE, tissues etc.
   ___ e. Decontamination procedures (chemical washes, shower in/out) needs
6. Biosecurity planning for Disease Events include considering the following:
   ___ a. Establishing hot, warm, and cold zones
   ___ b. Protocol for entry & exit (who/what and how)
   ___ c. Appropriate attire—depends really on where going next and are you at risk?
   ___ d. What to do with exposed material—syringes, trash, PPE, tissues etc.
   ___ e. Decontamination procedures (chemical washes, shower in/out) needs
Figure 8. Self-evaluation of Skills, Confidence and Perspectives within the VCR Program.

<table>
<thead>
<tr>
<th>ID</th>
<th>Topic/Discipline/Activity</th>
<th>Statement of Accomplishment:</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Sort of Yes, sort of No</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Don't Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ICS And NIMS Online Training via FEMA</td>
<td>&quot;I am prepared to operate within an ICS-based activity with minimal review of ICS and NIMS basics&quot;</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>General Principles Of Multi-Hazard Preparedness</td>
<td>I understand and can help others solve issues in, plan, and apply, a Multi-Hazard approach to preparedness and response</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>Table Top Exercise On Weather Related Disaster</td>
<td>... my ability to outline levels in response (personal through federal), allows me to compare and contrast planning &amp; for response at those levels</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>D</td>
<td>Psychological First Aid Presentation And Exercises</td>
<td>I can recognize signs of psychological distress in victims or other responders, and have the skill to relate to and assist such individuals in need</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>E</td>
<td>Euthanasia Presentation</td>
<td>I can describe humane euthanasia covering various species in disaster situations, and can enumerate the pros of different plans of operation involving euthanasia</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>F</td>
<td>Hazardous Materials Accidents Presentation</td>
<td>I can... safely identify, describe and assess a potential hazmat incident</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>G</td>
<td>Biosecurity For Affected Sites Discussion And Exercise</td>
<td>I can establish biosecurity zones (infected, decon, transition, clean, etc.) and ingress/egress protocols for an infected/contaminated site</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>H</td>
<td>Personal Protective Equipment Use In Investigating Outbreaks</td>
<td>I can apply the principles, and perform activities to don PPE gear, work in that gear, and remove that gear without contaminating myself or others.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
If you disagree or strongly disagree with any of the above statements, why? What improvements to the Credentialed Responder training would you suggest?

Any additional comments or suggestion to improve the Training Program?
CHAPTER 5: RESULTS

Executive Summary/Key Findings Outline

Research Question I: What Works: What are the key features of the VCR program that orient students to OH?

Research Sub-question Ia: What are the typological characteristics of change associated with the VCR program?

- Key Finding #1: Based upon the themes identified in the coding analysis, the VCR program is primarily an example of a teleological (planned) organizational change model.
- Key Finding #2: Based upon the themes identified in the coding analysis, the VCR program also has some attributes of a cultural organizational model.

Research Sub-question Ib: What are the key characteristics of successful (and unsuccessful) change efforts historically?

- Key Finding #3: The change model typologies (and their characteristic themes) are all represented in the four case histories.
- Key Finding #4: Characteristic themes that impeded organizational change within the four case histories are associated with the teleological, dialectical, and cultural change model typologies.
Research Question II: How well does it work: What is the efficacy of the VCR program in orienting and enabling students towards OH-PH practices?

Research Sub-question IIa: Does the VCR curriculum provide the students with the information and skill sets necessary to achieve the expected level of competency and knowledge for the eight identified core competencies?

- Key Finding #5: Significant improvement was seen in participants regarding the tested knowledge of PFA, Hazardous Materials, and Biosecurity and PPE.
- Key Finding #6: The majority of the respondents agreed that the VCR program made them feel comfortable and competent in performing duties across the program’s modules.

Research Sub-question IIb: Did the students value the training program and was the curriculum relevant to the students and their professional goals?

- Key Finding #7: Overall, the majority of the students valued the VCR training program and found the individual modules relevant to their professional goals. However, several key issues were identified as problematic which were related to the amount of material (too much/too little), time constraints, and a desire to maximize the amount of active, hands-on learning.

Research Sub-question IIc: Did the VCR program achieve its goals of improving capacity in Veterinary Public Health?

- Key Finding #8: Most students found the course to be a valuable tool which would facilitate future service and leadership within their communities. A small number of
students still desired additional training to improve their comfort level as subject matter experts.

- Key Finding #9: When prompted to provide input and constructive feedback on the course, three predominant themes emerged: 1) the desire for more active, hands-on learning within the VCR program, 2) the need for further information related to specific disaster response scenarios, and 3) the struggle with the ICS terminology and organization.

Research Sub-question IIId: Did the VCR program alter the paradigm in disaster preparedness and public health training within NCSU CVM and in Veterinary Medicine?

- Key Finding #10: The VCR program has altered the paradigm in disaster preparedness and veterinary public health education by successfully training 313 veterinarians in disaster preparedness over the last four years with the support of its educational, community and governmental partnership.

Research Question III: How can it be measured: What are the reported impacts of the VCR program on disaster preparedness?

Research Sub-question IIIa: Does the implementation and dissemination of the VCR program support the long term application of the OH concept of public health, in addition to developing new awareness, interest and leadership in the Veterinary Public Health profession?

- Key Finding #11: The VCR program has successfully established the long term application of a disaster preparedness program, based on the OH concept of public health and veterinary medicine. Furthermore, the VCR program has garnered local,
national and international awareness and interest while building capacity within the Veterinary Public Health profession.

**Introduction**

Four sets of documents were imported into the qualitative software package NVIVO-9: 1) The four Case Histories of paradigm shifts from Chapter 2, 2) the VCR program Description from Chapter 3, 3) a compilation of all student comments after each module/unit, and 4) students’ qualitative responses to an end of program formal course evaluation. These documents were then coded using the themes generated from the analysis of organizational change theory described in Chapter 2 as an initial coding guide. Each theme was identified and categorized into one of the six typological characteristics of change (evolutionary, teleological, life cycle, dialectical, social cognition, or cultural). The software program allowed for the coding of text in any quantity and according to multiple classification categories which facilitated thematic content analysis and the identification of emergent themes. Some of themes were predetermined (based upon change theory models) while others emerged in an iterative fashion based upon data from the student evaluations.

I. **What Works: What are the key features of the VCR program that orient students to OH?**

1a. What are the typological characteristics of change associated with the VCR program?

*Key Finding #1: The VCR program is primarily an example of a teleological (planned) organizational change model.*
The development, planning and implementation of the VCR program process was a leader-guided, planned, collaborative process based upon an established organizational need and recognized organizational benefit that was supported by a motivating vision.

**Leader Guided Process:**

One of the key characteristics that emerged from the analysis of the VCR program description was that it was a leader-guided process driven by a demand to meet society’s needs for veterinary professionals knowledgeable outside the discipline of clinical practice and able to bridge the gap between veterinary public health, agriculture, and human health. The Executive Doctoral Program in Health Leadership has had an enormous impact on me and my perspective on leadership and change. The DrPH program required me to integrate a broad set of skills, knowledge, and competencies outside of the standard scope of the veterinary medical profession. Furthermore, the moment I assumed the role of graduate student in the GSGPH at UNC-CH and stepped outside of my professional discipline, I began to appreciate the paradigm of public health from another perspective. This tested my previously held delineated boundaries between animal and human health. Once I concluded that a paradigm shift within professional DVM curriculum regarding disaster preparedness training was needed, my experience and training in the DrPH Program enabled me to make the curricular changes necessary to enact professional programmatic change.

**Partnership and Collaboration:**

Although I led the effort in the VCR program’s development, it is defined by its partnership with three organizational units (NCSU CVM, UNC CH GSGPH, NCDAC&S). The
impact of this collaboration on the successful implementation of the VCR program is significant. Without our partners’ commitment and engagement, the VCR program would lack the disciplinary expertise and credibility to claim an OH approach to disaster preparedness. It is imperative to foster and grow these new relationships between schools of public health and medicine (both human and animal) and with public health agencies at the federal, state and local level and formulate more extensive approaches to education that encompass the full scope of public health practice.

Organizational Need:

Outside of the realm of clinical practice, the veterinary profession is not currently meeting all of society’s needs. The traditional veterinary curriculum in place at most of the colleges and schools in North America does not adequately prepare students for careers that address the growing concerns of emerging animal disease, bioterrorism, agro-terrorism, and disaster preparedness and emergency response. Because of this oversight, current veterinary students are failing to embrace the full breadth of the veterinary profession. The VCR training program was purposely implemented and adapted in 2007 because my colleagues and I recognized that veterinarians are often called to plan for and serve in disasters and that our professional CVM curricular content had largely ignored emergency management instruction.

The veterinarian’s professional oath calls us to improve animal and human health by using our scientific knowledge and skills for the benefit of society. There are few more palpable ways to meet a mandate such as this than to be involved with one’s own community in preparedness and response.
**Organizational Benefits and Incentives:**

When developing the VCR program, the rewards or incentives for change and collaboration were very important to encourage the different partners to collaborate and channel efforts from existing activities (or curricular programs) to the VCR Training Effort. The range of incentives varied by institution or partner, but each found a compelling reason to engage in the change process. Faculty and staff from both NCSU CVM and UNC-CH GSGPH were motivated by being identified as leaders in emergency responder training, whereas veterinarians and program specialists from Emergency Management within NCDAC&S were motivated to provide trained professionals into the community for response efforts during disasters. In general, all organizations involved in the VCR program were compelled to engage in this educational change effort because of a recognized organizational need to train veterinarians in disaster preparedness and OH.

**Communication of a clear and relevant vision:**

Finally, the success of the VCR change effort heavily relied upon communicating a clear and relevant vision to both internal and external stakeholders. Each collaborative partner came to the training with a slightly different vision regarding the curricular content, focus, end product and goal of the VCR training program. Providing both a vision and direction and communicating the need for a change in training and curriculum were imperative to establishing a common goal between these three organizations. Furthermore, the VCR vision and goals were revisited prior to and in between each training module in order to address the informational drift in understanding among the stakeholders and students.
Key Finding #2: The VCR program also has some attributes of a cultural organizational model.

In addition to characteristics of teleological change, the VCR program also exhibited attributes of a cultural change model. In the VCR program description, the themes of institutional history and experience were identified as playing a significant role in the development and implementation of the VCR program. Furthermore, the themes of institutional culture and symbolism also played a role in the acceptance of the VCR program. Specifically, the institutional cultures of emergency management and the CVM both strongly embraced the symbolism of One Health, which contributed to the strategy to create this curricular change in training at NCSU. In the section below, the identified key cultural characteristics and themes associated with the VCR program are discussed.

Institutional History and a Tradition of Leadership in Disaster Response:

A long, unfortunate history of declared disasters, emergencies, and crises created an opportunity of organizational need. The late 1980s and 1990s brought significant weather-related disasters to North Carolina including hurricanes, floods, winter storms, and tornados. Specifically, Hurricanes Hugo (1989), Emily (1993), Bertha & Fran (1996), and Ivan (1999) all required major federal response and recovery operations by the Federal Disaster Assistance Administration. In response to North Carolina’s long history with weather-related events and crises, emergency management developed a track record of leadership, which has significantly shaped its strong commitment to multidisciplinary disaster preparedness training and its support for the VCR program.
Established One Health Ethos/Symbolism:

All three partners with the VCR program were champions of One Health and recognized that the convergence of people, animals, and our environment has established the inextricable connections of the health of each group. The One Health model provided a framework for the development of the new training program. A major goal of the One Health Initiative is the integration of education between human medical schools, veterinary medical schools and schools of public health. In an ideal world, an OH training program would weigh and measure the needs of and impact on all three domains in its search for sustainable solutions to global health problems and disaster response.

Ib. What are the key characteristics of successful (and unsuccessful) change efforts historically?

Key Finding #3: The four Program Case Histories revealed a heterogeneous range of all the change model typologies (and their characteristic themes) that both facilitated and impeded change.

The characteristic themes of successful organizational change efforts in the four case histories involve all of the six change model typologies: evolutionary, teleological, life cycle, dialectical, social cognition and cultural. As discussed in Chapter 2, distinctions exist among models of change. Some document how the change is actually occurring whereas others describe effective approaches or advocate an approach. Under each typological model of change, prominent characteristic themes were identified and described for each case history (Table 19).
Table 19. Characteristic typologies and themes identified that supported organization change within the four case histories.

<table>
<thead>
<tr>
<th>CHANGE MODEL TYPE</th>
<th>CHARACTERISTIC THEME</th>
<th>CASE HISTORY NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolutionary</td>
<td>Differentiation and accretion</td>
<td>1, 3, 4</td>
</tr>
<tr>
<td></td>
<td>Homeostasis</td>
<td>3</td>
</tr>
<tr>
<td>Teleological</td>
<td>A focus on leadership</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td></td>
<td>Vision</td>
<td>1, 2</td>
</tr>
<tr>
<td></td>
<td>Strategic planning</td>
<td>1</td>
</tr>
<tr>
<td>Life Cycle</td>
<td>Mature organizations</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Dialectical</td>
<td>Persistence</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Coalition building</td>
<td>4</td>
</tr>
<tr>
<td>Social Cognition</td>
<td>Single-loop and double-loop learning</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Mental models, enabling metaphors and language</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Learning organizations</td>
<td>2</td>
</tr>
<tr>
<td>Cultural</td>
<td>Deep transformation and paradigm shift</td>
<td>1, 2</td>
</tr>
</tbody>
</table>

Evolutionary Change Models Themes

Key themes of evolutionary change models identified were differentiation and accretion and homeostasis.
Differentiation and accretion refer to how an organization responds to society or the environment by taking on additional responsibilities. As an organization accepts or acquires greater responsibilities, increased organization complexity results in differentiation and growth. Case histories #1 and #4 are both strong examples of a profession responding to a perceived societal need. The first case history, the Carnegie Foundation Bulletin No. 4: The Flexner Report and its impact on medical training in the US (hereafter referred to as the Flexner Case Study), was a process of natural growth, catalyzed by the advancements of technology, medical science, and medical and surgical interventions which changed societal expectations of the medical profession. In the last case history, Case History #4, Clinical Prevention and Population Health Curriculum Framework: A New Public Health Curriculum Proposal for Health Professionals (hereafter referred to as the Preventive Medicine Case Study), the significance, magnitude and scope of health threats spurred eight health profession disciplines to attempt to define and introduce a prevention curriculum that could be incorporated into the training of all clinical health professions. Similar to the VCR Program’s theme of organizational need, the APTR rose to the challenge threatening the public’s health by establishing a framework as a basis for curricular change within the health professions. Conversely, Case history #3, Paradigm shift failed: A continued struggle to build national capacity and competency in primary care medicine (hereafter referred to as the Primary Care Case Study) was a clear example of a failed effort in differentiation and accretion primarily due to the lack of incentive for medical doctors to choose general or family practice over advanced specialty training. Despite the clear shortages and
overwhelming need for physicians trained in primary care, the numbers of medical doctors entering family practice continues to decline.

**Homeostasis**

Homeostasis refers to the way in which organizations (and organisms) make adjustments to their external environment.\textsuperscript{55} The Primary Care Case History exhibited characteristic themes of homeostasis by training and employing physician’s assistants and nurse practitioners to provide primary care in a direct effort to ameliorate the trend of physician shortage in primary care.\textsuperscript{109,123}

**Teleological Change Model Themes**

Key themes of teleological change identified in the four case histories were 1) a focus on leadership, 2) presence of a vision, and 3) presence of a strategic plan.

**A Focus on Leadership**

Three of the four cases exhibited change based on leadership at the individual and organizational level. Case #2, The Evolution of Nursing: From Nightingale to Metaparadigm (hereafter referred to as the Nursing Theory Case Study), had two strong individual leaders at two separate time points, Nightingale and Fawcett, who both recognized the necessity of change and were at the center of the process, aligning the goals and communicating the vision. The Flexner case study also had a leader, Abraham Flexner, whose role was to inventory and assess medical schools and to propose a standardized or idealized medical training program. Often termed as the Flexnerian revolution, Abraham Flexner’s report had an immediate and sensational impact on American medical education.\textsuperscript{77,78,81-85}
the colleges that were severely criticized by Flexner closed soon after publication of the report; others initiated extensive revisions of their policies and curricula.\textsuperscript{77,78,82-85} The Preventative Medicine Case Study highlighted the importance of the collaborative leadership theme. Here, collaboration involved multiple stakeholders from varying disciplines working to facilitate change through a shared governance structure and work of committees. Collaboration in this model entailed vision setting but has yet to work out the details of implementation.

*Vision*

Vision is central to the implementation of change.\textsuperscript{145,153,156,159,177,263-265} Change often involves risk and ambiguity; therefore it is necessary to articulate a compelling argument for its execution. The Nursing Theory Case Study identified why vision is so critical and why it can become the blueprint or compass for participants to move toward something new. Both Nightingale and Fawcett articulated a shared vision for what nursing as a profession should or could be, thus transforming our understanding of each organizational member’s contribution to the change process. Nightingale’s philosophical perspective and teachings were revolutionary to the wellbeing and care of patients in the nineteenth century and led to the establishment of nursing as a professional discipline.\textsuperscript{60,88,92,93} Fawcett’s metaparadigm represented a framework for nursing knowledge which encompassed the scope of all aspects of the discipline and knowledge, spelling out the phenomena of nursing in its most global manner.\textsuperscript{56-59} Both visions have endured and become embedded in the nursing culture.\textsuperscript{56-60,88,92,93}
Strategic Planning

Strategic planning is closely tied to the mission, objective and vision of change management. The Flexner Report was successful in changing medical training because it provided structure to the process of change with defined standards in admissions requirements, faculty credentials and training, curriculum, training facilities and teaching hospitals.

Life Cycle

In this model, change occurs as individuals within the organization adapt to its lifecycle and the outcome of change is a new organizational identity or mission. These models share many characteristics with evolutionary models in that change is a natural part of the maturation process.

Mature organizations

All of the change processes outlined in the four case histories occurred slowly over time. As mentioned in Chapter 2, change tends to be slower in older organizations. The case processes in three of the four case histories (The Flexner, Nursing Theory, and Primary Care cases) involved established organizations where change was gradual and slow, which highlights the fact that organizations proceed through different phases of a life cycle, similar to animals and people. As organizations evolve, the focus on internal processes and practices takes precedence over external pressures and events. This elaboration of structure is rooted in the organization’s tradition and history, which tends to create stability while limiting growth, learning and experimentation.⁵⁵,¹⁹¹
Dialectical

The dialectical change model was apparent in all four case histories through themes of persistence and coalition building.

Persistence

All four case histories displayed the characteristic theme of persistence, where change occurred because individuals, groups, or coalitions were determined, relentless advocates who provided ways to implement their agenda.

Coalition Building and Negotiation

The Preventative Medicine Case Study displayed some of the strongest themes of coalition building. The Healthy People Curriculum Task Force was a coalition of multiple disciplines and eight professional associations. The HPTF was an effective means of bringing together disparate interest groups and creating a power base to enact change. However, alignment of the interest and goals of powerful associations and interest groups to form a coalition also necessitated the ability to compromise and negotiate. The HPTF realized the need for flexibility for each clinical health profession to determine the recommended depth of curriculum, the timing for the teaching material and the methods for delivery; therefore, the task force chose not to identify specific competencies or learning objectives.138

Social Cognition

Social cognition models emphasize discussion and learning among the participants in the change process, including understanding of the process of change itself.55 Change in this model is tied to cognitive dissonance: people reach a point where values and action
clash with something that seems outmoded and they decide to change. The three themes identified from social cognition change models were 1) single-loop and double-loop learning, 2) mental models, enabling metaphors and language, and 3) learning organizations.

*Single-loop and double-loop learning*

Single-loop is defined as the improvement of existing norms or standards within an organization and is associated with first order change whereas double-loop learning is defined as a process by which existing norms or standards are restructured to create a new paradigm or operating standard. The case study that best represents both single and double-loop learning is the Preventative Care Case History. When the original launch of the Framework was not successful, the HPTF reformulated the Framework to better suit the needs of its partner organizations.

*Mental models, enabling metaphors and language*

Mental models, enabling metaphors and language are defined as internal images, assumptions and stories which assist in the change process by increasing the understanding of the participants of change. All the case histories used mental models, metaphors or language to either assist or resist the change process. One of the more effective uses of mental models was the Nursing History Case History, which used both the mental model of Florence Nightingale as a paradigm of good nursing practice and as a metaphor or symbol (metaparadigm) for organizational change.
Learning organizations

The theme of mental models led to the concept of the learning organization. The theme of mental models led to the concept of the learning organization. The theme of mental models led to the concept of the learning organization. The theme of mental models led to the concept of the learning organization. The theme of mental models led to the concept of the learning organization. The theme of mental models led to the concept of the learning organization.55,159

The Nursing Theory Case Study evidenced this theme of a learning organization with its development of peer-reviewed evidenced-based literature focused on course selection and curricular content starting in the 1950s. Simultaneous with the growth of nursing theory literature, masters and doctoral level graduate training programs arose.

Cultural

The Flexner and Nursing Theory case histories both displayed cultural characteristics that promoted change.

Deep transformation and paradigm shift

Altering the culture of an institution or organization through changing organizational beliefs, practices, and values requires shifts in paradigms, and is consequently uncommon and difficult to facilitate.55 The Flexner Case History’s transformation of the medical education system was a paradigm shift where, rallying around Flexner’s medical education philosophy, the combined efforts of the state licensing board, philanthropic foundations, and the Federation of State Medical Boards resulted in the eradication of proprietary medical colleges and the standardization of the laboratory- and hospital-based research medical university model.77,78,85

The Nursing Theory Case History also displayed characteristics of a cultural change: nursing transformed from a vocation to a profession. Through the collective efforts of the nursing profession and academia, the discipline of nursing theory emerged. This discipline serves as the organizing structure for the profession as a whole.
Key Finding #4: Characteristic themes that specifically impeded organizational change within the four case histories were associated with the teleological, dialectical and cultural change model typologies.

All four of the case histories had characteristic themes that impeded or imposed barriers to organizational change efforts (Table 20). In general, these barriers fell into three change model typologies: teleological, dialectical, and cultural.
Table 20. Characteristic typologies and themes identified that impeded organization change within the four case histories

<table>
<thead>
<tr>
<th>CHANGE MODEL TYPE</th>
<th>CHARACTERISTIC THEME IDENTIFIED</th>
<th>CASE HISTORY NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teleological</td>
<td>Lack of incentives</td>
<td>3,4</td>
</tr>
<tr>
<td>Dialectical</td>
<td>Interest group, power and persuasion</td>
<td>1,2,3</td>
</tr>
<tr>
<td>Cultural</td>
<td>History and traditions</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Irrationality and ambiguity</td>
<td>3</td>
</tr>
</tbody>
</table>

**Teleological**

The main teleological theme that emerged as a barrier to change was a lack of incentives. This theme was identified both within the Primary Care Case History and Preventive Medicine Case History.

**Lack of Incentives**

As discussed in Chapter 2, rewards or incentives frequently motivate individuals or organizations to change. Both the Primary Care and Preventative Medicine case histories lacked sufficient incentives to catalyze change. Within the Primary Care Case History, physicians lacked monetary incentives to choose primary care as a specialty. Furthermore, within the Preventive Medicine Care History – although there was a motivating vision to provide public health training – there was not enough reward to channel energies from existing activities (educating physicians, nurses, and health professionals in their specific disciplines) to facilitate change.
Dialectical

Interest groups and power, negative persuasion and influence, and the politics preventing change were all powerful themes within the case histories that presented barriers to change. Bargaining, arguments and conflict are a normal process in any change management cycle.\textsuperscript{265} How these processes are managed often determines whether a change process will be successful.

**Interest groups, power and persuasion.**

The Flexner Report, Nursing Theory, and Primary Care case histories exhibited the power of interests groups and their impact on change: The Flexner Case History overcame considerable political resistance to change and social inertia due to American distaste of authoritative rule that delayed national regulation of the medical profession.\textsuperscript{80} The Nursing Theory Case History highlighted the impact of special interest groups (physicians) and their power and capability to thwart (or not assist) nurses endeavoring to elevate their standing among their professional peers in academia and medicine.

In the Primary Care Case History, the AMA criticized the findings of its own task force, the CCMC, which recommended the provision of interdisciplinary preventative and therapeutic medical services, free access to public health services, group cost sharing of medical care, greater local and governmental responsibility of medical and public health services, and finally the expansion of professional education for wide variety of medical and public health personnel with emphasis on prevention and social considerations. Furthermore, established newspapers labeled the recommendation as a call for socialized medicine which quickly fragmented any debate on health care economics into a war of
alliances rather than a reasoned policy debate rooted in the science of economics and epidemiology.\textsuperscript{117,119,120}

**Cultural**

The major cultural themes identified that impede change are 1) history and traditions and 2) irrationality and ambiguity. Cultural change typically involves altering values, beliefs, myths, and rituals; individuals’ allegiance to histories and traditions represent potentially powerful barriers to change. Further thwarting change is irrationality and ambiguity, where people’s willingness to change is not defined by data or facts, but rather intuition or emotion. Ambiguity slows or blocks change within organizations by obscuring the change processes needing to take place.

**History and traditions**

Both the Flexner and Nursing Theory case histories displayed the theme of history and traditions, based upon social and historical norms and standards which impeded change. Medical training in the United States was varied, and disease and poor health were part of the public’s daily life and was therefore accepted without question.\textsuperscript{80} Similarly, nursing theory arose with difficulty within a world where no one knew what caused diseases, knowledge of germs was nonexistent, and “being hospitalized was akin to a death sentence and nurses were still mainly regarded as ignorant, uneducated persons”.\textsuperscript{60,88,92,93}

**Irrationality and ambiguity**

Irrationality and ambiguity cause inconsistency between organizational goals and actions. The ambiguity of the implementation process of organizational change within the
Preventative Medicine Case History has slowed the process of change. Questions related to the appropriate amount of individual tailoring for each health profession further impeded change and contributed to irrational roadblocks regarding programmatic coordination (“Health professionals are not simply technicians implementing guidelines and protocols” \(^{143}\)). Although the ATPM and the HPTF were commended for their work, many leaders within the member organizations expressed concern regarding the breadth of the Framework and thus its implementation. Furthermore, they voiced concern regarding the Framework’s prescriptive nature and the limitations of creating a common curricular framework considering the diversity of disciplines across the health professions, each with individual areas of need in terms of expertise, focus and emphasis.\(^{143}\)

II. **How well does it work: What is the efficacy of the VCR program in orienting and enabling students towards OH-PH practices?**

IIa. Did the VCR curriculum provide the students with the information and skill sets necessary to achieve the expected level of competency and knowledge for the eight identified core competencies?

*Key Finding #5: Significant improvement was seen in participants regarding the tested knowledge of PFA, Hazardous Materials, and Biosecurity and PPE.*

Pre- and post-test results for the following three core competencies were performed: PFA, Hazardous Materials, and Biosecurity/PPE were evaluated for 73 individuals. A paired t-test was performed to determine if the modules were effective.

**PFA**

The mean pre- and post-test scores for the PFA module were 31.19 and 41.44, respectively (Table 21). Total points possible were 50. The mean gain in points after the
module (M=6.14, SD=5.91, N=73) was significantly greater than zero, \( t(72)=8.87 \), two-tail \( p < 0.05 \), providing evidence that the educational module was effective in conveying the information. A 95% CI about mean point gain is 4.78-7.49.

### Table 21. Pre- and Post-test Scores for the PFA Module (Max score = 50).

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>PRE-TEST SCORES</th>
<th>POST-TEST SCORES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>37.19</td>
<td>41.44</td>
</tr>
<tr>
<td>Median</td>
<td>38</td>
<td>41</td>
</tr>
<tr>
<td>Range</td>
<td>13-46</td>
<td>33-46</td>
</tr>
</tbody>
</table>

**Hazardous Material**

The mean pre- and post-test scores for the Hazmat module were 22.46 and 26.39, respectively. Total points possible were 30. The mean gain in points after the module (M=3.92, SD=3.38, N=75) was significantly greater than zero, \( t(74)=10.03 \), two-tail \( p < 0.05 \), providing evidence that the educational module was effective in conveying the information. A 95% CI about mean point gain is 3.15-4.69.
Table 22. Pre- and Post-test Scores for Hazmat Module (Max score = 30).

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>PRE-TEST SCORES</th>
<th>POST-TEST SCORES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>22.47</td>
<td>26.39</td>
</tr>
<tr>
<td>Median</td>
<td>23</td>
<td>27</td>
</tr>
<tr>
<td>Range</td>
<td>10-27</td>
<td>17-29</td>
</tr>
</tbody>
</table>

**Biosecurity and PPE**

The mean pre- and post-test scores for the Biosecurity and PPE module were 22.97 and 26.17, respectively. Total points possible were 30. The mean gain in points after the module (M=3.20, SD=3.58, N=69) was significantly greater than zero, t(68)=7.43, two=tail p <0.05, providing evidence that the educational module was effective in conveying the information. A 95% CI about mean point gain is 2.36-4.05.

Table 23. Pre- and Post-test Scores for Biosecurity and PPE Module (Max score = 30).

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>PRE-TEST SCORES</th>
<th>POST-TEST SCORES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>22.97</td>
<td>26.17</td>
</tr>
<tr>
<td>Median</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>Range</td>
<td>15-30</td>
<td>16-30</td>
</tr>
</tbody>
</table>

**Key Finding #6: The majority of the respondents agreed that the VCR program made them feel comfortable and competent in performing duties across the program’s modules.**

A self-evaluation survey of skills, confidence level and perspectives in the defined set of core competencies was completed by 97 people over two years of the program (N=63 in 2009 and N=34 in 2010). All survey responses were measured using Likert scales (1=strongly agree through 5=strongly disagree). Analysis of responses on the post-training evaluation tools may be summarized as follows:
• Based upon the summary of central tendency of the self-evaluation of skills, confidence and perspectives, seven of the eight required competencies “agreed” or “strongly agreed” that the VCR program made them comfortable and competent in performing duties across each of the program’s modules. The only competency that had a measure of central tendency less than 2 was the Need or Role for Veterinarians in a Crisis (Median = 2; Mode = 3) (Table 24).

• Greater than 80% “Agreed” or “Strongly Agreed” that the VCR program made them comfortable and competent in performing duties across the following program’s modules: PFA, Euthanasia, Biosecurity, and PPE (Table 25).

• 74% “Agreed” or “Strongly Agreed” that the VCR program made them comfortable and competent in performing duties outlined in the Hazardous Materials module.

• The 3 modules that received the least endorsement by respondents (All Hazards Approach, ICS/NIMS, and Need/Role for Veterinarians in a Crisis) still had greater than 50% of respondents who “agreed” or “strongly agreed” that the program made them comfortable and competent in performing duties associated with each module (68%, 55%, and 51%, respectively) (Table 25).
Table 24. Summary of Central Tendency of the Self-evaluation of Skills, Confidence and Perspective for the Eight Required Competencies within the VCR program (Likert Survey Results for 2009-10; 1=strongly agree through 5=strongly disagree).

<table>
<thead>
<tr>
<th>YEAR</th>
<th>VARIABLE</th>
<th>ICS/NIMS</th>
<th>PFA</th>
<th>EUTHANASIA</th>
<th>BIOSECURITY</th>
<th>PPE</th>
<th>HAZMAT</th>
<th>ALL HAZARD</th>
<th>NEED/ROLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>Median</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Mode</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Response Range</td>
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<td>1-4</td>
</tr>
<tr>
<td></td>
<td>Response #</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>62</td>
<td>63</td>
<td>62</td>
<td>62</td>
<td>62</td>
</tr>
<tr>
<td>2010</td>
<td>Median</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<td>Response Range</td>
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<td>1-5</td>
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<tr>
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<td>Response #</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (2009-10)</td>
<td>Median</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Table 25. Likert Survey Summary Results for the Self-evaluation of Skills, Confidence and Perspective for the Eight Required Competencies within the VCR program (2009-2010; 1=strongly agree through 5=strongly disagree).

<table>
<thead>
<tr>
<th>YEAR</th>
<th>VARIABLE</th>
<th>ICS/NIMS</th>
<th>PFA</th>
<th>EUTHANASIA</th>
<th>BIOSECURITY</th>
<th>PPE</th>
<th>HAZMAT</th>
<th>ALL HAZARD</th>
<th>NEED/ROLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1+2</td>
<td>36</td>
<td>58</td>
<td>54</td>
<td>57</td>
<td>57</td>
<td>51</td>
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<td>33</td>
</tr>
<tr>
<td></td>
<td>4+5</td>
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<tr>
<td></td>
<td>3</td>
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<td>5</td>
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<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Response #</td>
<td>63</td>
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<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>1+2 (%)</td>
<td>57.14</td>
<td>92.06</td>
<td>85.71</td>
<td>90.48</td>
<td>90.48</td>
<td>80.95</td>
<td>76.19</td>
<td>52.38</td>
</tr>
<tr>
<td></td>
<td>4+5 (%)</td>
<td>4.76</td>
<td>0.00</td>
<td>0.00</td>
<td>4.76</td>
<td>0.00</td>
<td>1.59</td>
<td>3.17</td>
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IIb. Did the students value the training program and was the curriculum relevant to the students and their professional goals?

Qualitative data were collected after each module/unit via email query in which the instructor sought informal input, assessment, and comments from the students and participating faculty. Data were scanned and coded for themes, categories, patterns and relations associated with the VCR program. The themes identified are discussed in detail and are followed by representative quotes from the student comments.

**Key Finding #7:** Overall, the majority of the students valued the VCR program and found the individual modules relevant to their professional goals. However, several key issues were identified as problematic which were related to the amount of material (too much/too little), time constraints, and a desire to maximize the amount of active, hands-on learning.

ICS/NIMs Training

Student comments regarding the online self guided FEMA modules generally acknowledged that understanding ICS/NIMS infrastructure was an important and necessary part of disaster preparedness training. Although most students valued the training overall and found it interesting, some found it to be time-consuming and somewhat boring to complete.

*I think today's class exercise was very important. It solidifies the ICS emergency training in our minds. I think people who have never been in a disaster first hand or who have never been in organizations developing preparedness plans cannot even fathom the implications and all that goes into planning relief efforts. This training will allow us as veterinary professionals to extend a helping hand where our hard earned skills are needed.*

*The FEMA training wasn't too bad. I have to admit saying that I have no interest in the topic, but keeping that in mind, I've had worse training and computer-based programs I've had to take. I do like how we were able to complete the training in our
own time and able to retake the test (I had to take the 2nd test twice). The program is well-run and I didn’t find any glitches. I think that although it’s not my top choice how to spend my time, I did learn about disaster training, which may be beneficial in the future.

The training other than taking a lot of time to present a rather small amount of info I thought was useful and I absolutely love the idea of being trained to be able to volunteer during times of need. So, well worth it.

However, many of the students questioned the balance and focus of the training on organizational structure and titles to be too detailed and confusing. Many students also complained that they would never remember the vast majority of the material given the emphasis on ICS structure, titles, jargon and terminology, rather than what they perceived as the larger issue: what they should DO in an emergency situation. Some students also felt that the training was redundant with their required courses in epidemiology.

I found the training to be interesting, yet very focused on organizational structure and titles much more than how to handle an emergency situation. I understand that it must be general to encompass all types of emergencies and that organizational structure is very important to making sure that efforts remain organized, but the courses were not really what I was expecting/hoping for.

The training was ok, however, it is very confusing though, but I do see how it is necessary as my boyfriend is an oil spill responder in Alaska and is dealing with the various levels of command of ICS right now and I hope to join him as a responder later on in life.

Quite honestly I felt the training was a little bazaar [sic]. The vast majority of it was blatantly redundant while at the same time non-specific enough so that you really don’t learn much beyond the acronyms and arbitrary titles for different positions which are instantly forgettable because they never actually go through any type of scenario for using any of the information. At some point the emphasis on the acronyms, the arbitrary names (unified command, unity of command, etc with different definitions) just became painful.

The training was good but I did feel some repeat between this half and last semester (Public Health and Epidemiology).
I feel that the training, although very important, was a bit repetitive and monotonous. I remember wondering how the 100 and 200 levels were different from each other. I also feel that a lot of emphasis was placed on the titles of positions rather than the actual jobs of the individuals with those titles.

PFA

Almost all of the students enjoyed the PFA module and felt that it was a valuable and relevant component of the training program. Many students perceived that the PFA module was a part of a larger continuum of communication training, which they felt was lacking within the curriculum. In particular they enjoyed the PFA activity and worksheet that detailed the components of a PFA.

I really enjoyed the lecture on psychological first aid. It seems like something that is extremely important in dealing with disaster victims, yet something that I, and probably many others, could easily overlook or fail to consider.

I thought that Psychological First Aid portion of class was a good start in getting us to think about how to talk to traumatized people. I think we should have looked at it more in the context of an owner with a critically ill pet, which is more of an individual disaster then a large scale disaster because that’s what we are going to face every day. I liked the exercise where we thought about what to say to someone experiencing a disaster because knowing what to say is the toughest thing in helping traumatized people.

I liked the worksheet where we had to think about what we would say to a disaster victim. I feel like it is easier to sympathize from a distance than to actually make contact with an individual and be of assistance, so I thought it was good practice for us.

Many of the students felt that there was not enough time devoted to this module and expressed concern regarding their lack of comfort when communicating with individuals in crisis. Some students wanted additional course time specifically devoted to grief counseling and pet loss, while others felt that we were training them to be “under qualified psychiatrists”.

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There was not enough to get through the psychological first aid.

Lastly, we also tried to spend an hour on physiological first aid. Not to be cold, but we only have so much time to try to learn the valuable information and somehow we’ve missed how to operate the shelter, but we are now extremely under qualified psychiatrists.

Many members of our profession (especially at the vet student level) could use help communicating with clients more effectively. We may never know what to say to someone who’s grieving for a terminally-ill pet, no matter how many times we’ve actually been a part of it. It’s also important to be able to communicate with PFA on that individual level as well as a natural/man-made disaster level. It would have been beneficial to spend half the time talking about how to communicate with the grieving client, and the other half about the person affected by disaster. Both have benefits for our future careers, and I like that it kind of takes us out of our comfort zone and into a place that we’ll be forced to face in practice.

This reminds me of the fact that communication as a whole is just not emphasized in our curriculum and it is a huge part of who we are as clinicians.

I think it is far more practical to discuss client-doctor interactions with regard to PFA rather than large scale disasters. I personally know of many veterinarians that are excellent in the medical area and poor in communication. I strongly feel this is something that needs to be addressed with future veterinarians.

Euthanasia

As with the PFA modules, almost all students found it interesting and valued the Euthanasia module. Similarly, they expressed the desire to devote additional time to this topic, given the topic’s perceived importance to disaster training and their future professional roles as veterinarians. Given the number of euthanasia techniques discussed, many students noted that further discussion of species-specific techniques, especially those involving depopulation, were warranted. Also, many students remarked that this was the first time they had witnessed euthanasia in a horse where the equine oriented students wanted more detail regarding field euthanasia in horse and large animal species. A number of students again voiced the desire for continued training in grief counseling, especially in
the context of the euthanasia setting. Many students remarked on the importance of the information within this module, given the veterinarian’s role as subject matter expert on animal issues within the community. However for many students, these lectures raised even more questions regarding many of the euthanasia procedures deemed acceptable by their governing professional body, the AVMA.

*Today's lecture was very informative; I was unaware of all the different options for livestock euthanasia. I feel this information is vital for us to know, not only for board exams which we are pointed towards often, but in order to explain the practicality of these methods to our clients. People will often see videos online or on TV about the horror of livestock euthanasia and the inhumane killing of horses and cows with captive bolt (I have had the discussion with my mother many times!). You may be asked your opinion in a small animal clinic or in a conversation with a stranger at the grocery store. It’s nice to have the resources and knowledge to provide facts to these people and the ability to justify these acts in our profession. We all need to know about all aspects of the industry and should defend our actions - we do take animal welfare first and foremost and as we educate the public, they will hopefully gain a new understanding that decreasing animal suffering is a top priority (regardless of what PETA and other radical organizations may think).*

*I also appreciated the lecture. I remember hearing about the use of foam for mass poultry euthanasia last semester, and I think we were all a bit shocked by it. I was concerned today to hear that the birds are not confirmed dead with carbon dioxide and I now think less highly of that relative to the foam. At least with the foam you might be able to verify death. I also had some concerns that captive bolt seems to be advocated for any livestock species. How many species has it been studied in? When we discussed euthanasia earlier this semester, there was a hypothesis that the bolt is too long for sheep and passes through their brain, causing death to be prolonged. I think the bolt is fine for cattle, but can we really extrapolate that it will be okay for euthanasia in so many other species? I would like to see more research, and perhaps different lengths of captive bolts for different animals.*

*I really enjoyed today’s lecture on appropriate euthanasia and got a lot of good information and advice. I liked the format of the lecture also, that it included the logistics of the procedure, as well as the emotional aspect. I have seen several different protocols (IE sedation first, catheter or no catheter, etc.) and I am starting to get a feel for the procedure that I prefer, and I think it’s really important to understand the decisions we make and the impact it has on the owners. In the future, I think this lecture could be continued for another day, if scheduling allowed of course, and it would be helpful to go into some of the legal aspects of euthanasia*
(touched on it today about the wife/husband scenario, etc).

Today’s lecture gave us a lot of good information on the topic of euthanasia, which is such a sensitive one. I enjoyed hearing the opinions from several different clinicians on ways to make such a horrible experience a little bit better for you, your client, and most of the entire patient. I definitely will carry the information with me into practice for my own experiences.

I thought it was an excellent lecture yesterday and one that was definitely needed. I’ve never seen large animal euthanasia before and am looking forward to learning more about that in lecture today.

Biosecurity and PPE

Student comments regarding the Biosecurity module and the PPE activity were very similar as they were conducted on the same day and entailed similar concepts. Most students found both modules to be very helpful and practical. They also enjoyed the active, hands-on approach to the PPE exercise and saw its relevancy to their future practice and daily life. One student remarked that they had “a deeper respect and understanding of the material” after the PPE activity.

Maybe no one in our class will ever again don or duff a bunny suit. We could look at the experience as an opportunity to drive home the importance of biosecurity, however, which not one of us can say is irrelevant to our chosen focus. I died yesterday. What if that rubber chicken had been a puppy with lepto, and the powder granules on my neck were instead bacteria that I brought home to my five-year-old? NOT a pleasant scenario. Or maybe I thought I was clean, and continued to my next appointment. Business gone. Perhaps I’m compelled to write because I learn by doing rather than by hearing things once. Dr. XXX has drilled me for two and a half years in biosecurity concepts. After yesterday, I have a deeper respect and greater understanding of what exactly it is he’s been harping on for so long. I fail to see how the experience could be [of] no value to me, or even of less value than another spay surgery. That’s just me, though, and I understand that I’m perhaps more the exception than the norm.
Hazardous Material Safety

Concerning the Hazardous Material module, although the students mostly enjoyed the lecture material and found the contents interesting, they failed to understand its relevance to their role in a disaster situation. Many other student participants wished that this portion of the training had a hands-on component or active-learning segment.

*Though the HazMat lecture was good, I didn't understand how or why it is imperative for vet students to hear this lecture. I can't think of an incident, other than a spill on the highway, where a vet would be involved, and in this case, I (as a vet) would be a bystander. Do med students, law students, undergrad students receive education on what to do if there is a spill?*

*I liked the chance to go through the Hazmat exercise today, and I wish there was more hands-on scenarios to work through.*

*Let's become subject matter experts in taking care of animals in disaster situations; not worry about 15 bubbles of ICS above and below us, or different types of flammable materials, or trying to understand the human psyche in an hour.*

All Hazardous Approach to Disaster Preparedness

Students’ comments regarding the All Hazardous Approach module acknowledged that the tabletop exercise provided valuable preparation for their future professional life. However, many students also expressed the desire for more hands-on and active-learning to improve understanding of the All Hazards Approach to disaster preparedness. Furthermore, a large portion of the students expressed frustration with lack of specificity and desired a discussion of the specific disaster situations and their roles and responsibilities.
In the case of disaster response, let's face it; we can never, ever know when a crisis will strike our communities. It doesn't have to be a major disaster - we're not necessarily talking about Haiti here. It could be something as common as a multi-vehicle car wreck, an oil spill, or an ice storm that brings down power lines all over town. We're each going to be a member of the medical profession, which is historically a group of people that, when hardships hit, victims look to for aid and guidance. I don’t have to tell any of you that medicine is a highly esteemed profession for which we give up many years of our life to achieve membership and competency. People recognize these facts. We are veterinarians, not electricians, but when that ice storm hits the respect we've garnered, our services to the community to date, may stand out in the minds of our neighbors, and *presto* we’re in charge of figuring out how to get the road to the highway cleared – by default. Colleagues, we’re trained to problem solve in highly stressful situations! Not everyone is as lucky. You may be the most qualified person at hand to address a hardship in your microcosm community. Personally, I appreciate the opportunity to think and prepare now, in advance, rather than being forced to figure something out in the middle of the situation.

This module is very important because you never know when there is going to be a Foreign Animal Disease Outbreak or natural disaster.

I think it would be a lot more helpful if we did discuss specific disaster situations such as tornados, blizzards, tropical storms etc because that would help narrow down what and how to plan/cope with the situation.

It was good that Dr XXXX spent time on the importance of the training, but I felt like I walked away yesterday with very little idea of what to actually DO in a disaster. There are so many different orgs- SART, CART, Response teams, etc and I'm not sure what listserv or org I need to be a part of in order to be called up.

Personal and Business Continuity Planning

Student comments regarding the personal and business continuity planning module were mostly positive. Most of the comments focused on the usefulness of the exercise for their personal and professional lives, specifically related to emergency preparedness. Some students remarked that they were going to use the skills obtained from the module to educate future clients. Other students remarked that they “felt prepared” and enabled. Overall, this module was highly valued by the VCR participants.
I think one of the most useful things I took away from the training session last week was the idea of having a disaster preparedness kit to send home with clients prior to a disaster ever happening. I think clients would appreciate having the information and guidelines. It might be useful to demonstrate what such a kit might include.

I think this will be something very useful to have that we can use to build on and refine our emergency plans from year to year.

I think that one of the best ways to prepare for an emergency is to have clients already educated on what to do and where to go. We touched on this a little bit, but I feel that panic is what makes emergencies more of an emergency, so clients and owners that already have a plan will be beneficial to themselves and the situation.

The personal plan made me actually talk with people and get boxes together, so I actually feel prepared now!

During today's lab/lectures another classmate (who I will leave out of this unless they want to be named) and I were chatting about the overall usefulness of the current portion of the class (disaster response). I was thinking that maybe there are some aspects of this course that have more relevance than others. For instance, creating a personal disaster plan seems to me to be extremely valuable for every single person (even if we're not going to be in North Carolina after school or if we have no pets). However, maybe everybody is not going to volunteer for disaster relief (different state, different priority, whatever reason).

Understanding of the Need/Role of the Veterinarian in a Crisis Situation

Student comments were universally positive regarding the training about the need/role for veterinarians in a crisis situation. Most students commented about the importance and benefits of training, which was viewed as universally applicable. Many students also commented that it opened their eyes to the variety of roles that a veterinarian can and should assume within society. Additionally, a few students commented regarding the trusted position of the veterinarian and our professional obligations to our community, both human and animal. Finally, although most students expressed gratitude that this training would enable them to provide leadership in a crisis.
situation, many students also wanted additional, specific information about the role of a private practitioner in a disaster situation.

I strongly believe that this course is a needed component of the curriculum. I also think this course is an important part of the curriculum; many lectures addressed issues that we will be faced with in practice.

I have really enjoyed this class. It has really opened my eyes to a variety of different issues in the veterinary field these days. I also think it is an extremely important part of our curriculum.

I do believe this is a much needed course, for one, because it challenges people to really "learn" themselves and the type of person they are. A lot of the situations presented are very realistic and each forces one to decide the course of action he/she would take.

I am really glad that we are going through the emergency response training. I hope that this will always be a requirement at NCSU- CVM. It is very important because you never know when there is going to be a Foreign Animal Disease Outbreak or natural disaster. I think Dr. XXX did a good job of applying the information to daily practice as well. I am looking forward to the activity at TAU and hope that the rest of my classmates see how valuable this information and experience is to our future.

I think people who have never been in a disaster first hand or who have never been in organizations developing preparedness plans cannot even fathom the implications and all that goes into planning relief efforts. This training will allow us as veterinary professionals to extend a helping hand where our hard earned skills are needed.

I do appreciate that we had some exposure to response to emergency situations. These skills will be valuable in the future.

You could totally replace the word "disaster" with "vet school experience" and virtually all of the same principles discussed would still apply! I really enjoy the opportunity to prepare myself to be involved during a disaster.

I think it is great that we are discussing disaster training. I think the public assumes/trusts that vets know what to do for animals in a disaster and it is surprising that we are the only school who has any exposure.

I would have liked to hear about the specific roles Vets play in these disasters and what communities expect of Vets in a disaster situation. Also, I would have liked to hear about exactly how a private practitioner can apply to help in these disasters,
who would they contact, and is there any additional training beyond this course that
is expected.

Miscellaneous Comments Regarding the Specific Module Content

Additional student comments related to the desire for additional training in human
cardiopulmonary resuscitation (CPR) and multispecies First Aid training.

*I think it is shameful that I am almost a 4th year vet student and do not know how to
perform canine & feline CPR. Why is this not a part of our program? We are much
more likely to encounter small scale disasters (house fire, car wreck, dog kicked by
horse, etc.) than large scale ones (hurricane, earth quake). No matter what focus you
may have, you are likely to come upon a dog or a person needing immediate first aid,
and as a vet, you should be able to handle it. I think this is more important than
learning how to handle an AI outbreak, which even if it does occur, most of us will
not be dealing with directly.

The other major trend in student comments was related to individual lecturer
teaching style and philosophy. Many of the major participants in the course were not
educators by training but were experts in the field used to lecturing to individuals who were
indoctrinated in the discipline in emergency management. Many of the students wanted to
shift the focus away from the ICS structure and terminology towards their perceived
practical implementation of emergency aid.

*I eventually got a bit lost in the terminology and jargon.

It was good that Dr XXX spent time on the importance of the training, but I felt like I
walked away yesterday with very little idea of what to actually DO in a disaster.
There are so many different orgs- SART, CART, Response teams, etc and I not sure
what listserv or org i need to be a part of in order to be called up.
It would be helpful to follow it up with real simulations with Dr. XXX.

Ilc. Did the VCR program achieve its goals of improving capacity in
Veterinary Public Health?
An end of program formal course evaluation that included queries focused on content, relevancy, process, context, and pace was performed for years 2009 and 2010 in an effort to further assess whether the VCR training achieved its goals on improving capacity in Veterinary Public Health. Similar to the previous section, data were scanned and coded for themes, categories, patterns and relations associated with the VCR program. The themes identified are discussed in detail and are followed by representative quotes from the student comments.

**Key Finding #8: Most students found the course to be a valuable and enabling tool, which would facilitate future service and leadership within their communities. A small number of students still desired additional training to improve their comfort level as subject matter experts.**

Overall, the students’ comments in the formal course evaluation were extremely positive regarding the VCR Training program. Many found the course to be an excellent addition to the curriculum which allowed them to explore new areas of veterinary medicine and their professional responsibilities within the community. Most found the modules to be extremely relevant to their careers, were enabled by the training, and were planning “to respond in future emergencies”.

*Thank you!!! This training has lighted a fire for me and a more involved veterinary career in my local community/county.*

*Very valuable program! I know I will feel more comfortable after actually participating in an event. I feel very excited to know that I am prepared to effectively serve my community and nation in a disaster. Thank you for all of your hard work and dedication to this course.*

*Discussing disaster plans really gets us at least thinking about what we would do and is good to get vets more involved overall in community involvement.*

*I like the thought of seeing veterinarians more active in the community. I too feel*
that vets are becoming more business oriented and less involved in the overall good 
of the community. Thank you all for your time and positive attitude throughout this 
course.

I think this training and experience is very valuable and I recognize it is a difficult task 
to take on - thank you for making the investment in us!

While most students viewed the training as an investment in their future, a portion 
of the students still did not perceive themselves as subject matter experts and felt 
uncomfortable assuming leadership roles in a disaster situation or crisis. Some remarked 
that they still felt unprepared, mostly due to the volume of material covered in the course 
and would need additional training to actually participate in an event.

Not very confident in ability to help others plan for multi-hazard event as I did not 
really gain an in depth understanding of the information

I think it should be stressed to us that once we respond to an event, we will be told 
what to do, where to go and that our uncertainty of responding will be relieved once 
we do it once. I think people don't respond and won't deploy if they feel vulnerable 
and unsure of what will be asked of them

It is just a lot of material and it's hard for me to feel comfortable saying I am totally 
prepared and remember everything I need to know to respond to a disaster, but I am 
definitely more comfortable than I was before class.

I feel that after going through the training, I would not feel prepared for working 
with most disasters. I don't think I would feel comfortable jumping into ICS based on 
the training.
Key Finding #9: When prompted to provide input and constructive feedback on the course, three predominant themes emerged: 1) the desire for more active, hands-on learning within the VCR program, 2) the need for further information related to specific disaster response scenarios, and 3) the struggle with the ICS terminology and organization.

Active, hands-on learning experiences

Many students expressed that they learned more while doing, which is a form of experiential learning.

More hands on activities that could re real-life scenarios ex) walk through what you would do if you came across: a chemical spill, an overturned trailer holding animals, etc.

I would like to have some hands on labs demonstrating a simulation of how to euthanize various species.

Maybe some "real life" scenarios with situations and we have to act it out and respond.

Responder training - more active, hands on scenarios, the poultry house scenario was great and much easier to learn/remember when I've physically done it.

Desire for more specifics

Many students also expressed a desire for more specifics regarding “real life” scenarios and contact information. Several students felt that this would improve the learning environment of the course (“It would be more fun”) and the practical implementation of the training tools in the future. Most related that this type of information would enhance their ability to participate in a disaster or crisis scenario.

After completing the course I still don't really know who to contact when I get out if I want to help. Maybe give some local contact info within North Carolina?

Specific scenario using ICS structure would be helpful and the real life / relatable discussion would be engaging I think.

Some more practical or situation lectures, meaning what to actually do in a disaster.
I thought it was good - perhaps more scenarios and real-life situation discussions. Also, I think a list of who to call / what agencies to contact (i.e. direct contact #s) in case of disaster.

I would also like to know supplies you should typically bring (medical supplies) to respond to animal emergency. I would like to know specifically who to contact

I want more specifics on what orgs to join to be called up:
- Who handles what disasters and how
- What we can do (alone or in a team) to help
- Leadership - how to break a team into effective pieces
- Temp shelter set up
- For Large Animal people - how to rescue horses/ cows

Struggle with ICS terminology and organization

Almost all students struggled with the 9 hours of online training. Issues related to the informational delivery online format, the ICS terminology and abundance of unfamiliar acronyms, and the perceived complex organizational structure of the FEMA system were all common themes. Again, the students desired “real life” examples of ICS to improve their understanding of ICS and to reduce boredom and confusion.

It is difficult to gain or retain information using an online module system. I feel that I just read the material to answer the questions but did not really gain an in depth understanding of the information. It did not seem to be a good use of time for the information gained. I am not sure what a better approach to the material would be but for me the online modules were not effective.

It would have been helpful to go through a real life scenario that makes use of the ICS, such as an AI outbreak. Who would run the operations, logistics, etc. and what actions/tasks would they complete in the event of an AI outbreak?

Having a few examples of what I would actually do in a scenario would make understanding the levels and working with ICS better.

More situational analysis of previous disasters responses would be a more interesting way to learn the ICS concepts. Assigning roles (like Incident Command) is a fun way to help illustrate the concepts.
I would like some more experience with the format in ICS in order to feel more comfortable than just the online training.

IId. Did the VCR program alter the paradigm in disaster preparedness and public health training within NCSU CVM and in Veterinary Medicine?

Key Finding #10: The VCR has altered the paradigm in disaster preparedness and veterinary public health education by successfully training 313 veterinarians in disaster preparedness over the last four years with the support of its educational, community and governmental partnership.

The Professional DVM curriculum at NCSU and its relationship to the VCR program

NCSU CVM is currently ranked number three by US News and Reports and is one of the top veterinary educational programs in North America. A combination of a low student/faculty ratio, low resident tuition, a university wide commitment to learning in a technology rich environment and high quality facilities contribute to a rewarding and stimulating environment in which to learn. The academic professional program calls for two phases of education: a preclinical-didactic training phase and clinical phase. The preclinical-didactic phase is three years in duration and is directly followed by the clinical phase in the fourth and final year of the professional DVM training program. The first through the third year of the professional program are concerned with a gradual progression from a basic science presentation to a more clinical application of veterinary science. Two summer vacation periods are allowed in the first three years of the professional program. Each of the first 6 semesters in the curriculum are divided into a 13 week core course period followed by two weeks of "selectives." Individual selectives are one or two weeks in length, each week corresponding to one academic credit. All
students are required to complete two credits of selectives in each of the first six semesters.\textsuperscript{267}

The format of the last or fourth year of the professional program calls for a "block system" approach to clinical education.\textsuperscript{267} The academic calendar is divided into 2-week or 1 month segments.\textsuperscript{267} Students are required to successfully complete a minimum number of courses for graduation.\textsuperscript{267} Off-campus experiences are possible in private practice, industry, federal government, and/or post-doctoral opportunities. Four 2-week vacation blocks are possible during the fourth year of the program.\textsuperscript{267} The clinical program provides a heavy emphasis for actual "hands-on" clinical practice and is demanding both physically and mentally.

In 2004, the faculty of the college changed the curriculum to allow student selection of focus areas in their DVM education.\textsuperscript{267} The goal of the focus area concept is to allow students to increase their depth of training in their intended area of post-graduate activity, while still retaining a broad based veterinary education.\textsuperscript{267} Currently, there are nine focus areas within the veterinary curriculum. The nine focus areas and the student distribution are listed in Table 26.

<table>
<thead>
<tr>
<th>FOCUS AREA</th>
<th>NUMBER OF STUDENTS /(%):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinician Scientist</td>
<td>6/1.95</td>
</tr>
<tr>
<td>Equine Practice</td>
<td>59/19.15</td>
</tr>
<tr>
<td>Food Animal</td>
<td>30/9.74</td>
</tr>
</tbody>
</table>

As discussed in Chapter 3, the majority US veterinary colleges have not comprehensively incorporated disaster management education within their curricula.\textsuperscript{195} Dwindling state and college resource, multiple demands on an already broad curricular agenda, and current curricular trends towards specialty training and companion animal medicine have all played a significant role in the shift that what was traditionally seen to be core clinical and didactic training in veterinary medicine.\textsuperscript{195} To address the predicted critical shortage of veterinarians, particularly in governmental service, public health and food animal practices, the CVM took steps in several major action steps in the following areas: 1) Admissions committee members are made aware of shortage areas; 2) Tracked admissions programs were established to address critical shortage areas in food animal practice, public health and laboratory animal medicine; and 3) Students interested in shortage areas were mentored to prepare them for success in those careers.\textsuperscript{267} Furthermore, the CVM has continued to offer leadership in this area and is playing a key role in promoting OH awareness and understanding by the establishment of the VCR disaster preparedness training program to train students, which is regarded as a national model in emergency response for veterinary medicine. It is in this climate that NCSU CVM administrative

<table>
<thead>
<tr>
<th>Lab Animal Medicine</th>
<th>6/1.94</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed Animal Practice</td>
<td>23/7.45</td>
</tr>
<tr>
<td>Epidemiology and Public Health</td>
<td>4/1.3</td>
</tr>
<tr>
<td>Small Animal Practice</td>
<td>120/38.96</td>
</tr>
<tr>
<td>Zoological/Exotic Animal Medicine</td>
<td>42/13.64</td>
</tr>
</tbody>
</table>
leadership and faculty have fully embraced and supported the VCR program for the past four years.

The VCR program is housed in the third year of the preclinical didactic curriculum. Since 2008, 313 people, predominately professional DVM students in their third year of a four year program have participated in the VCR program. Average class size per training session is 77 students. It is the intent of the College to train a sufficient number of veterinarians that they provide the capacity to serve the entire state of North Carolina and beyond.

The mission of the Emergency Program Division of the NC Department of Agriculture and Consumer Services is to reduce the vulnerability to or the impact from, any disaster, disease or terrorist attack on the agriculture community of North Carolina. North Carolina is divided into five emergency regions which are the under the responsibility of four emergency program veterinarians and three emergency program specialist. In an event of a crisis, these individuals work from emergency operational centers (EOCs), to deploy resources for agricultural and animal related emergencies. Given their limited numbers, they need veterinarians trained in disaster preparedness within each community to provide to provide leadership at the local level. Through the VCR program, we will soon have enough veterinarians trained in emergency preparedness that will ensure an altered paradigm in disaster preparedness and public health.

III. How can it be measured: What are the reported impacts of the VCR program on disaster preparedness?
IIIa. Does the implementation and dissemination of the VCR program support the long term application of the OH concept of public health, in addition to developing new awareness, interest and leadership in the Veterinary Public Health profession?

Key Finding #11: The VCR Program has successfully established the long term application of a disaster preparedness program, based on the OH concept of public health and veterinary medicine. Furthermore, the program as garnered local, national and internal awareness and interest while building capacity within the Veterinary Public Health profession.

Since the implementation of the VCR program, there has been considerable response from outside stakeholders. Fifteen universities and agencies have expressed interest in replicating the program through either observing or participating in portions of the training program or requesting the program’s material/course note packet and PowerPoint slides (Table 27). Furthermore, the American Veterinary Medical Association has initiated discussions with NCSU CVM and NCDACS in 2010 on recommending such training be required core material for all USA veterinary colleges, using the NCSU VCR program as a template.
Table 27. University and Agencies Expressing Interest in the VCR Program as a Model of Disaster Preparedness.

<table>
<thead>
<tr>
<th>UNIVERSITY</th>
<th>GOVERNMENTAL AGENCY</th>
<th>PROFESSIONAL ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auburn University</td>
<td>Dept of Homeland Security (DHS)</td>
<td>American Veterinary Medical Association (AVMA)</td>
</tr>
<tr>
<td>University of Florida</td>
<td>United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS)</td>
<td>American Association of Veterinary Medical Colleges (AVMC)</td>
</tr>
<tr>
<td>Texas A &amp; M</td>
<td>National Alliance of State and Agricultural Emergency Program (NASAEP)</td>
<td></td>
</tr>
<tr>
<td>University of Saskatchewan</td>
<td>Wake County Human Services (Divisions of Public Health and Emergency Management)</td>
<td></td>
</tr>
<tr>
<td>Colorado State University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iowa State</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washington State University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Louisiana State University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecole Nationale Vétérinaire d’Alfort</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Calgary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 6: DISCUSSION

The evaluation and analysis of the literature reviews on disaster preparedness and change management, the case history reviews on change within health professions, and the qualitative and quantitative programmatic report were designed to provide insight to the dissertation’s three research questions from multiple perspectives. The objective of the literature review on disaster preparedness was to provide insight on curriculum and training programs in preparedness training across disciplines in order to create a new OH training program for veterinary medicine. The review on change theory was designed to understand the process of change, particularly as it related to educational and programmatic change. The goal of the case histories review and thematic coding of change processes within health professions was to understand how and why change occurs and does not occur. And finally, the program report, evaluation and analysis were intended to describe the curriculum, evaluate its strengths and weaknesses, and assess its success as a model of OH training within veterinary medicine. This chapter contains a discussion of the results from the above outlined objectives and goals and is organized under the three research questions.

To review, the three fundamental research questions were designed to test the hypothesis, “Novel thinking/skills (strongly related to OH) can be successfully instilled in students through a single credentialing program” and are as follows:
• **Research Question 1:** What works: What are the key features of the VCR program that orient students towards OH?

• **Research Question 2:** How well does it work: What is the efficacy of the VCR program in orienting and enabling students towards OH-PH practices?

• **Research Question 3:** How can it be measured: What are the reported impacts of the VCR program on disaster preparedness?

Throughout the discussion chapter, I will explore the concept that the implementation and dissemination of the VCR program might support the long term application of the OH concept of public health, in addition to developing new awareness, interest and leadership within the Veterinary Public Health profession.

**Research Question 1: What Works: What are the key features of the VCR program that orient students to OH?**

The creation and implementation of the VCR program at NCSU CVM clearly establishes that a disaster preparedness training program can provide a platform for multidisciplinary collaboration to obtain optimal health of people, animals and the environment in the event of a crisis. As discussed in the results section, the key features that led to this particular curricular and education change are well-rooted in classic teleological and cultural change theory models as articulated by Lewin, Lippitt, Kotter, and Schein.\(^{177,187,188,265,268}\) Interestingly, many of the key themes identified in the VCR program can be summarized in a modified version of Kotter’s famous eight-step change model and enumerated below:\(^{265}\)
Step 1: Establish an impelling mental metaphor which articulates a clear need for the skills, knowledge and training (Organizational need and established one health ethos/symbolism)

Veterinary colleges and schools have a critical role to play in our understanding of human, animal and environmental health issues associated with public health issues and disaster response. Currently, the veterinary profession is not prepared to meet society’s needs in public health, public service, or disaster preparedness. The present, rigid educational model that is based upon a narrow definition of veterinary medicine prevents the profession from realizing its potential as a health care leader. Curricular change is vital to ensure that all graduates are prepared individually and collectively to help our nation and world in the event of a crisis or disaster situation. Establishing a disaster training program based upon the OH model guarantees that our graduates have a better understanding of their social and professional responsibility for human, animal and environmental health issues within their communities.

Step 2: Gather a leadership team of strong collaborative partners to design, promote and execute the training program (Leader guided process and tradition of leadership in disaster response)

The key lessons in North Carolina’s past successes in disaster response and emergency preparedness are in its close partnerships between academia, government and nongovernmental agencies. History and experience has taught us that the health of the public can be assured only through the cooperation and collaboration of many individuals from diverse institutional settings and professional roles. Moving forward, it is imperative to continue to develop new relationships within universities between public health schools and schools of medicine (both human and animal), and with public health agencies at the
federal, state and local level and formulate more extensive approaches to education that encompass the full scope of public health practice.26

The VCR program is characterized by close partnerships and collaboration with the UNC-CH GSGPH and the NCDA&CS Emergency Programs Division. These practical and symbiotic relationships benefit all parties by creating and sharing knowledge, building capacity, and establishing networks and infrastructure, all while building a resource of skilled and enthusiastic veterinary responders. The program is also a powerful and effective example of the OH concept: the training for animal preparedness and response mirrors and completes the training for human preparedness and response.

**Step 3: Define and agree upon new core competencies in veterinary medicine**

In an effort to define a new set of core competencies in health–related emergency and disaster preparedness for veterinary medicine, a literature review was performed. Until now, universal core competencies in emergency preparedness for veterinary medicine had not been specifically identified. The literature review yielded several comprehensive articles on training programs specific to health care disciplines, such as public health, nursing, dentistry and medicine; however most of the current training programs are housed within post-professional continuing educational and certificate programs.15,32,196,208,214,215,220,221

Post-professional programs are an inefficient mechanism to create an integrated OH framework within veterinary medicine for disaster preparedness and emergency response. The eight core competencies outlined in the VCR program serve as models for a mandated
embedded training disaster training program. The professional DVM curriculum needs to be modified to include disaster training to ensure that we are able to function as members of an OH health care team.

**Steps 4 & 5: Discuss the new core competencies and training program with the college and its administrative leadership and faculty (Communication of a clear and relevant vision (e.g. My personal leadership story) and implement the VCR program**

Universities and colleges have rigid, hierarchal structures that are based upon programmatic need to maintain both their educational mission and the accreditation standards for professional educational programs. This internal dynamic can create administrators and faculty who are adverse to change and risk. Despite these obstacles, the evolutionary dynamics of differentiation and accretion or the presence of innovative leadership may facilitate programmatic change. Knowing the processes and people needed to evoke change is also important.

**My Leadership Story**

The VCR program is a tale of opportunity and leadership. In 2007, I was given the opportunity to become the course coordinator of VCM 962: Veterinary Ethics, Jurisprudence, and Professional Development. It had recently undergone a course credit reduction (from four to two credits) and repositioning in the curriculum which had relocated the course from the first year to the third year of a four-year curriculum. As such, VMC 962 was ripe for redefinition and restructuring. At the same time, I was fortunate enough to have been accepted into the DrPH Program at UNC-CH GSGPH and had developed a clear understanding of the necessity of providing relevant and multidisciplinary
OH training to veterinarians to enable and promote their successful participation in the sensible resolution of pressing global problems. To do this, I felt that the curriculum needed to take a more comprehensive approach to veterinary medical training. As a complete overhaul of the entire veterinary curriculum was not currently within my purview, restructuring VMC 962, a core component within the curriculum, seemed like the appropriate starting point.

In the spring of 2007, after extensive research and reflection on the roles and opportunities for veterinarians acting as health care professionals, I launched VMC 962, re-titled, “Animal Welfare, Ethics and Social Responsibility”. This newly designed course examined the social, legal and ethical issues behind the science of veterinary medicine framed in the context of OH. Students enrolled in the course were expected to develop the ability to critically evaluate ethical issues related to veterinary medicine and animal welfare (including human) from multiple perspectives, in addition to gaining the basic leadership and operational training necessary to become a federally credentialed responder.

After its first successful completion, the Associate Dean of Academic Affairs and the curriculum committee voted to include the VCR program in a list of requirements for clinical competencies for all classes after the year 2011. This is a list that is mandated by the AVMA Council on Education (COE) which guarantees that all veterinary graduates have the basic scientific knowledge, skills and values to practice veterinary medicine, independently, at the time of graduation. As part of their accreditation, all schools/colleges must ensure that their graduates are competent in providing entry-level health care for a variety of animal species. As of 2011, NCSU CVM required all graduates to complete the VCR
credentialing program which enables them to become to be by FEMA as first responders as part of the professional degree requirements for a DVM.

**Step 6: Conduct a formative programmatic evaluation**

Formal programmatic evaluation was important as it allowed the program developers to assess the VCR program’s content, delivery, and quality of implementation (see the section under Research Question II for specific results of the evaluations). Formative evaluations strengthen or improve the object being evaluated as they assess the program’s fidelity (e.g. What were the key features of specific modules that worked?; Did the modules orient the students towards OH?; What was the efficacy of the VCR program at orienting students towards OH-PH practices?).

**Step 7: Decide how the new OH approach may be used for the entire profession and prepare an implementation plan (Strategic Planning)**

The goal in creating the VCR program was to develop a model training curriculum which was embedded in the core curriculum of the professional DVM degree and was based on OH disaster preparedness and emergency management. A key characteristic that enabled the OH approach and curricular content of the VCR program was its strong strategic collaborative partnerships within government and academia from other disciplines. To increase the numbers of veterinary medical schools and colleges whose basic curriculum for veterinarians include the core competencies outlined in the VCR program, a strategic plan for dissemination of the VCR model is necessary and will be described in detail in Chapter 7’s Plan for Change.
Effective dissemination and implementation of the VCR program to all veterinary colleges and schools nationally will lead to a veterinary profession that considers it their professional responsibility to provide services across species boundaries. Ultimately, the VCR program is intended to build capacity in OH preparedness by training all future veterinarians to respond and lead in the event of any disaster, agricultural or otherwise.

**Step 8: Articulate the connection between this new OH approach and develop the means to ensure the success of the VCR program as a national model for OH disaster training and preparedness for veterinary medicine** *(Deep transformation and paradigm shifts)*

Connecting institutional and individual identity to a change process has been linked to successful implementation and commitment to the change process (referred to as confirmation and adoption in change theory nomenclature). In particular, social cognition and cultural theories both emphasize that deeply entrenched beliefs, habits and norms are the foundational components of how one defines one’s character and individuality or an organization’s culture. Therefore, it was critical to the VCR’s success on both the individual and organizational level that the program becomes part of what it is to be a veterinarian.

On an institutional level, NCSU CVM has taken ownership in the program by establishing it as a core clinical competency for all its graduates. Furthermore, the college has received significant praise and attention at the local, state and national levels for its leadership with this program. Furthermore, the AVMA, AAVMC, USDA APHIS, and DHS have all cited and promoted the VCR program as a national model of disaster preparedness training within veterinary medicine. On an individual level, students now have the clinical skills to respond and assist their community when in crisis.
However, as indicated in the results section, not all of our students understand or identify with this expanded role of veterinarians. Moreover, some students have expressed that they do not feel it is their responsibility to provide leadership outside of their professional practice of veterinary medicine. This leads me to believe that we have failed at some level, in some of our students, to fully connect the leadership responsibilities associated with the VCR program with the responsibilities most typically associated with veterinary medicine. Most of the lack of identification with the expanded role of veterinarian as a health care professional and leader in disaster response may be related to the failure of the course to impart enough information in a tangible fashion so that the students feel like subject matter experts. In addition, the timing of the course within the curriculum may also play a role. Given that this course falls late in the semester of their third and final year of the didactic curriculum, it is often viewed as the “last hurdle” prior to getting to their “real” training as veterinarians in the clinical hospital. Some of this sentiment is evidenced by the students’ comments expressing the desire to “do something.” As such, I believe that a certain amount of the students’ dislike of the material would be avoided by converting the format of the material to a more hands-on and interactive format.

Implementing this OH model on a national level is an ambitious undertaking; it will require a decades-long coordinated effort by many individuals, partners and collaborators within academia. The VCR program partners aim to help facilitate this process and build on their past accomplishments at NCSU CVM. However, there is a certain risk in assumption of plasticity of people (i.e. we cannot assume that people will change), which is
a weakness in both the teleological and cultural models. It is not always possible to create change and it is a bias of innovation to assume that a program will be adopted without adaptation or some level of rejection.\textsuperscript{55,278} Overcoming this pro-innovation bias will be addressed in the next section when we discuss the program effectiveness and limitations.

**Research Question II: How well does it work: What is the efficacy of the VCR Program in orienting and enabling students towards OH-PH practices?**

The results indicated that the VCR curriculum provided veterinary students with the information and skill sets necessary to achieve the expected level of competency and knowledge for the eight identified core competencies. Students showed significant improvement in their tested knowledge of PFA, Hazardous Materials, and Biosecurity and PPE, and most respondents agreed that the VCR program made them feel comfortable and competent in performing duties across the program’s modules. Overall, the majority of the students valued the VCR program and found the individual modules relevant to their professional goals. The following table summarizes the key themes identified for each of the eight identified core competencies of the VCR program.

**Table 28. Summary of the Key Themes Identified for Eight Identified Core Competencies of the VCR Program.**

<table>
<thead>
<tr>
<th>MODULE AND COMPETENCY VARIABLE</th>
<th>THEMES IDENTIFIED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Command System &amp; National Incident Management System</td>
<td>ICS/NIMs were identified as was important (but painful) to understand, but the learning of the organization structure was difficult, and monotonous. Furthermore the online modules were frequently identified as repetitive, redundant and too focused on what was perceived by some as pointless bureaucracy.</td>
</tr>
<tr>
<td>Psychological First Aid</td>
<td>PFA was identified as an important and highly valued module on basic communication principles in crisis, however the students</td>
</tr>
<tr>
<td>Module</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Euthanasia Physiology &amp; Mechanics</td>
<td>The Euthanasia module was also highly valued by the students as it was perceived to be extremely informative, filling in key curricular gaps regarding euthanasia concepts of multiple species. The module raised many additional questions/concerns regarding euthanasia and again students voiced the desire for additional client counseling and grief management training. Furthermore, they wanted more time and detail on the euthanasia of equine and large animal species. Several students suggested the addition of separate lectures focus on equine and depopulation procedures to module.</td>
</tr>
<tr>
<td>Biosecurity</td>
<td>The Biosecurity module was identified as both practical and pragmatic, with informational content that was relevant to both daily practice and crisis situations.</td>
</tr>
<tr>
<td>Personal Protective Equipment</td>
<td>The PPE activity was very popular due to the hands-on aspect of the module. Students valued and appreciated the exposure to the concepts of the PPE exercise as they perceived the concepts as being applicable to both daily practice and crisis situation.</td>
</tr>
<tr>
<td>Hazardous Materials Safety</td>
<td>The students wanted more active, hands-on learning material and several students relayed that they did not feel like subject matter experts in this area. Furthermore, several students questioned the relevance of the module to their professional training.</td>
</tr>
<tr>
<td>All Hazard Approach</td>
<td>The All Hazards Approach to Disaster Preparedness Training was viewed by the students as valuable preparation for their future professional lives. Students expressed the desire to have more active, hands-on learning in an effort to improve understanding of the All Hazards Approach to disaster preparedness. Additionally, a portion of the students expressed frustration with lack of specifics and desired a discussion of the specific disaster situations and their roles and responsibilities.</td>
</tr>
<tr>
<td>Personal/Business Continuity</td>
<td>The personal/business continuity exercise was perceived as useful and practical by the students and applicable for future client education management and materials. Students remarked that they “felt prepared” and enabled. Overall, this module was highly valued by the VCR participants.</td>
</tr>
<tr>
<td>Need/Roles For Response Certified Vets</td>
<td>Comments regarding this module were universally positive regarding the training and an understanding of the need/role for Veterinarians in a crisis situation. Many students made remarks regarding the importance and benefits of training, which was viewed as universally applicable. Many students also commented that it opened their eyes to the variety of roles that</td>
</tr>
</tbody>
</table>
a veterinarian can and should assume within society. Additionally, a few students commented regarding the trusted position of the veterinarian and our professional obligations to our community, both human and animal. Finally, although most students expressed gratitude that this training enabled them to provide leadership in a crisis situation, many students also wanted additional information and more specifics regarding the role of a private practitioner in a disaster situation.

### Key Effective Areas of the VCR Program

In summary, most students found the VCR program to be a valuable tool, which would facilitate future service and leadership within their communities. In particular, students expressed very positive attitudes about, interest and awareness in, and appreciation of the PFA, Euthanasia, PPE, Biosecurity, and Personal/Business Continuity operational planning modules. On the surface, the success in each of these areas can be attributed to the practical and pragmatic course material that can readily be applied to daily practice. However, in addition, all these modules also contained more cognitively complex material which engaged the students in the learning process.\(^{218}\)

Furthermore, most of the students enjoyed the hands-on, active learning processes of the PPE and PFA learning modules, which are part of the psychomotor domain, characterized by progressive levels of basic motor skills, coordination, and physical movement.\(^{239}\) Here, both physical behaviors and knowledge are learned through repetitive practice.\(^{239}\) Results suggest that the modules with the higher level of cognitive and psychomotor engagement also contributed to the students’ affective learning domain,
which gauges an individual’s emotions towards learning experiences (Chapter 3), and thus contributed to the students’ positive emotions toward learning experiences.  

**Key Areas Needing Improvement in the VCR Program**

As documented in the results section, a number of students still desired additional training to improve their comfort level as subject matter experts. When prompted to provide input and constructive feedback on the course, three predominant themes emerged: 1) the desire for more active, hands-on learning within the VCR program, 2) the need for further information related to specific disaster response scenarios, and 3) the struggle with the ICS terminology and organization. These themes all represent key areas needing improvement in the VCR program that must be addressed prior to further dissemination and implementation.

**Active, hands-on learning**

Many of the students expressed the desire for more active, hands-on learning. Teaching large classes (>80-100 students) can be particularly challenging. Large lecture halls impose physical and logistical constraints on lecture format. In an effort to reduce class size, the VCR program has divided a class into two simultaneously taught groups for many of the VCR modules (i.e. tabletop exercise, Biosecurity and PPE training, and Hazmat awareness lecture). Although this necessitated teaching the material twice, it did allow for increased face-to-face interaction and small group activities. Future VCR trainings will also include more opportunities for cooperative learning where students will be expected to work on specific group projects, such as sample informational brochures on frequently
asked questions about avian influenza or disaster planning guides for their clients). These assignments will encourage positive interdependence and individual accountability (where everyone in the team is responsible for a portion of the assignment; if one team member fails to meet his or her responsibilities, everyone loses in some way). Furthermore, this guided face-to-face interaction also encourages the development of teamwork skills (leadership, time management, effective communication, and conflict resolution) to create a meaningful learning experience in an active learning format.

**Specific response information**

A number of the students’ comments also detailed the desire for additional information on detailed response operations pertaining to specific crises (tornados, motor vehicular wrecks involving animals, wildfires, acts of terrorism, and collocated shelter set up and procedures). In an effort to address these concerns, the VCR program has added a short introduction to North Carolina Veterinary Responders Corps (NCVRC), which is a federally-funded program administered through the NCDA&CS and ServeNC. The mission of the NCVRC is to train and prepare professionals in the animal care community to respond to disaster events (all hazard) that affect both production and companion animals. At this time, participation in NCVRC is limited to licensed veterinarians and veterinary technicians, veterinary students, animal control officers and cooperative extension agents and represents a mechanism for student involvement in organized response efforts. Students will be invited to enroll to receive specific information about responding in North Carolina and beyond.
Additionally, specific training on the necessary mobile infrastructure, technical support and standardized forms for collocated sheltering has been added to the VCR curriculum. In this active learning session, students work with the Companion Animal Mobile Equipment Trailer (CAMET), which contains all the supplies needed for physical setup, logistic requirements and administrative requirements and operation for a companion animal shelter (Image 4-6). Specific topical material provided during this shelter training includes information pertaining to regional shelter activation, emergency operations center (EOC) interactions (state/county/site communication), command issues, co-location sheltering, transitioning from evacuation mode to extended stay mode at the shelter, sheltering operations (check in, large animal vs. small animal, etc.), and demonstration and participation in CAMET deployment and set-up.
Image 4. CAMET Training Orientation
Understanding ICS and NIMs is essential for participating in any large-scale crisis or incident. However, making the ICS terminology and organization palatable to students is difficult due to the perceived difficulty of the material, abundance of acronyms and technical jargon. Assuring that part of the ICS terminology is inserted into mock exercises will help with the familiarization of the concepts and allow the participants to work an incident from a command perspective. This will allow students to have a working knowledge of the organizational terminology and contribute to their understanding of interagency coordination and communication.
Research Question III: How can it be measured: What are the reported impacts of the VCR program on disaster preparedness?

NCSU CVM has successfully implemented and delivered a disaster preparedness program over the last four years, training over 313 veterinarians to date. Furthermore, the VCR training program has garnered local, national and international awareness and interest while building capacity within the Veterinary Public Health profession. As the numbers of our training graduates grow, so does the veterinary profession’s capacity and responsibility to serve. Ultimately it is our goal to have a VCR graduate and FEMA first responder at every practice in the state of North Carolina and beyond who could handle emergent crises within their own communities as well as deploy if asked to respond.

The impact of this professional paradigm shift is significant as it would mean that the program had successfully created a change event which covered the complete extent from creation, evaluation, early adoption, and general acceptance of the disaster preparedness and community leadership on both an individual and professional level within veterinary medicine.
CHAPTER 7: PLAN FOR CHANGE

As stated in Chapter 1, the purpose of this dissertation is to answer whether we can develop a course that promotes a new paradigm in public health and disaster preparedness within veterinary medicine. The VCR program represents a national model of an OH training paradigm and has been established as a core component at one of the top three veterinary colleges in the United States. The implementation and evaluation of this educational paradigm shift has led to the following recommendations which are applicable to any professional health curriculum exploring new and novel curricular change that bridges species and disciplinary boundaries.

**Recommendation I: All veterinarians should be trained in disaster preparedness and response**

Currently in the United States, there is a shortage of veterinarians trained in public health, disaster preparedness, and emergency response despite the obvious needs created by climate change, bio/agroterrorism, natural disasters, and the emergence and growth of drug and multidrug resistant pathogens. Veterinarians have an important role to play as members of a multidisciplinary healthcare team and a social responsibility to provide veterinary leadership in the event of an emergency, due to their unique skill sets in
comparative medicine, science and population health. To prepare the veterinary profession to meet this challenge, the VCR program should be formally adopted as a national model for training health professionals on OH disaster preparedness.

As detailed in Chapter 6, I have employed the following steps (1-6) to create this program. Step 7 necessitates strategic planning and is discussed in detail in this Chapter under My Strategic Plan for Change:

1. Establish an impelling mental metaphor or image which articulates a clear need for the skills, knowledge and training (*Organizational need and established one health ethos/symbolism*)

2. Gather a leadership team of strong collaborative partners to design, promote and execute the training program (*Leader guided process and tradition of leadership in disaster response*)

3. Define and agree upon new core competencies in veterinary medicine (*As detailed in Chapter 3: The Veterinary Credentialed Responder Program*)

4. Discuss the new core competencies and training program with the college and its administrative leadership and faculty (*Communication of a clear and relevant vision*)

5. Implement the VCR program (*As detailed in Chapter 5: Results*)

6. Conduct a formative programmatic evaluation (*Also detailed in Chapter 5: Results*)

7. Decide how the new OH approach may be used for the entire profession and prepare an implementation plan (*Strategic Planning*)
Recommendation II: All veterinary colleges and schools incorporate disaster training and emergency preparedness into their DVM professional programs

Veterinary colleges and schools should be encouraged to create or incorporate disaster preparedness curricula into their DVM professional programs to improve capacity in emergency preparedness and to create awareness of what veterinary medicine can contribute to public health and community service on a local, state, national or international level. The importance of need for increasing the numbers of veterinarians entering leadership roles in public and animal health programs and emergency response is so great that relying on entrepreneurship by individuals or single institutions to establish training program will be inadequate. Optimally, training must take place during the core preclinical phase of education to ensure that students in all DVM focus areas are adequately prepared and have the appropriate skills sets to respond and lead.

Curricular change of this magnitude can take time and require multiple strategies as discussed in Chapter 2. The VCR program is offered as a model that can be used by colleges and schools desiring to incorporate disaster training and emergency preparedness into their DVM professional programs. As detailed in Chapter 3, the program is a comprehensive tool that details core competencies, curricular content, and an implementation strategy. Furthermore, as the recognized accrediting body for veterinary medicine, the AVMA COE should consider including disaster training in its requirement standards for veterinary education leading to a professional degree.

Recommendation III: Change theory and programmatic evaluation can be used to understand and facilitate the development, planning
and implementation of new educational paradigms and innovative programs

Chapter 2 reviewed both the language for understanding organizational change and the six main categories of change. Use of change theory to develop and implement the VCR program assisted in the successful execution of change event at both an individual and organizational level. Change, especially when it is large in scope or paradigmatic in nature, is difficult. A complex set of research-based principles emerged from this study that promoted or reinforced the VCR program development, planning and implementation.

Programmatic evaluation was also important to gain an understanding of the program operation, to document the program effectiveness and to examine its strengths and weaknesses (Chapter 5). Programmatic evaluation of the VCR program established that the VCR program is an effective curriculum that provides students with the information and skill set necessary to orient and enable students towards OH and disaster response. For instance, programmatic evaluation on the first few offerings of the VCR program uncovered the following:

Overall, the majority of the students valued the VCR program and found the individual modules relevant to their professional goals. However, several key issues were identified through programmatic evaluations as problematic which were related to the amount of material (too much/too little), time constraints, and a desire to maximize the amount of active, hands-on learning. To improve the VCR program’s impact and relevance, the learning objectives should incorporate an active, hands-on learning format that clearly
articulates the need for veterinarians trained in response and minimizes the terminology and jargon associated with the ICS infrastructure.

My Strategic Plan for Change

As detailed in Chapter 6, a strategic plan is necessary to successfully implement the above three recommendations. Accordingly, my Plan for Change will involve the following steps: 1) the publication of the VCR program in a peer-reviewed journal, 2) introduction and dissemination of the framework at professional conferences and meetings via posters, lectures and panel discussions, and 3) facilitated integration of the training program to veterinary colleges and schools by sharing the course content, materials, and resources.

Publication of Research on VCR Program Efficacy and Effectiveness

Because the veterinary academic community relies heavily on peer-reviewed literature to stay abreast of innovations in health education and training, published programmatic descriptions and assessments of the VCR program are expected to assist faculty at each veterinary college and school to assess, develop and incorporate disaster preparedness and training programs within their core curriculum. Several articles are planned featuring specific VCR module training curricula content, strategies, lessons learned and evaluation. Targeted journals for publication of abstracts and articles will be the Journal of Veterinary Medical Education, the Journal of the American Veterinary Association, the Journal of Public Health Management and Practice, and the International Journal for the Scholarship of Teaching and Learning.
Introduction, Dissemination and Adopting of the VCR Program

The VCR Training Program will be distributed directly to the membership of the Association of American Veterinary Colleges (AAVMC), which is the organizational body of academic veterinary medicine that coordinates the affairs of all 28 U.S. veterinary medical colleges, all five Canadian colleges of veterinary medicine, nine U.S. departments of veterinary science, eight U.S. departments of comparative medicine, eight international veterinary schools, three veterinary medical education organizations, and four affiliate international veterinary schools. The association represents more than 4,000 faculty, 5,000 staff, 10,000 veterinary students, and 3,000 graduate students at these institutions.

The mission of the AAVMC is to provide leadership for and promotes excellence in academic veterinary medicine to prepare the veterinary workforce with the scientific knowledge and skills required to meet societal needs through the protection of animal health, the relief of animal suffering, the conservation of animal resources, the promotion of public health, and the advancement of medical knowledge. As such, AAVMC pursues its mission by providing leadership in: 1) Advocating on behalf of academic veterinary medicine; 2) Serving as a catalyst convener on issues of importance to academic veterinary medicine; 3) Providing information, knowledge and solutions to support members’ work; and 4) Building global partnerships and coalitions to advance our collective goals. It thus provides an ideal platform to introduce and disseminate the VCR Program model.

Currently, the AAVMC is focused on two educational issues that are germane to the dissemination and implementation of the VCR Program model: 1) North American Veterinary Medical Education Consortium (NAVMEC) and 2) Emerging and Exotic Disease of
Animals (EEDA) and USDA Initial Accreditation Training. NAVMEC’s mission is to develop a new roadmap for veterinary medical education in the twenty-first century that is responsive, collaborative and flexible. Spearheaded by the AAVMC, NAVMEC’s effort is the most comprehensive ever undertaken to ensure that veterinary medical education meets society’s changing needs. Specifically, the consortium is looking at how education models, accreditation and licensing can all work together to create a workforce of next-generation veterinarians. The EEDA and Initial Accreditation Training is focused on preparing veterinarians who can serve on the front line of detecting infectious and/or zoonotic animal diseases. Both the USDA and AAVMC are looking to prepare veterinarians to have the ability to quickly recognize and respond to emerging and exotic animal disease.

Furthermore, AAVMC is committed to equipping veterinarians and those who educate them with up-to-date tools and resources that are required to play a leadership role, including sharing of the best of practices. As a member of the AAVMC community, I have been invited to speak and present abstracts at their annual conference in 2010 and 2011. In addition, NCSU CVM faculty have been asked by both NAVMEC and USDA APHIS to develop plans to enhance the efficiency and effectiveness of veterinary medical education specifically that entail incorporating the VCR model, which is consistent with their own OH philosophies.

**Facilitated Integration, Adaptation, and Application of the VCR Program**

A formal and integrated curriculum in disaster preparedness and emergency management is essential if all veterinarians are expected to understand, respond and
provide leadership in the event of a crisis, disaster or disease outbreak. However, formal curricular change that spans multiple institutions can take time and requires flexibility. As discussed in the last chapter, resistance to change is a common phenomenon for both individuals and organizations.\textsuperscript{287} The characteristic themes impeding change are universal and predictable as identified in the case histories in Chapter 2. Briefly, they are:

- The lack of incentives or perceived relative high cost of change;
- The presence of powerful interest groups who believe that change is unnecessary, not feasible or may result in the loss of power;
- The presence of history and traditions that see change as a threat to values and ideals; and
- The presence of irrationality and ambiguity that creates resentment to change all create barrier to implementing significant change.

Efforts to implement change in an organization are more likely to be successful if a leader or change agent understands the reasons for resistance to change and why transformations efforts fail.\textsuperscript{174,287} Although the VCR program provides a curricular template based upon agreed core competencies that can be duplicated or modeled at other institutions, the successful implementation at NCSU CVM may not be enough encourage curricula change at other colleges and schools. Leading change in an organization or academic institution that is resistant or unprepared to change is one of the most difficult responsibilities a leader can face.\textsuperscript{187,265} In the following paragraphs, I will discuss the necessary actions I must take to implement the VCR program on a national basis, focusing on professional veterinary programs that are resistant to or unaware of disaster and
emergency management training’s value in veterinary medicine, using a modification of Kotter’s eight step change model.\textsuperscript{265}

In order to establish the VCR program as a model of OH disaster preparedness training within DVM professional curriculum nationwide, I must: 1) Establish a sense of urgency, 2) form a powerful guiding coalition, 3) and 4) create and communicate a vision, 5) empower other to act on the vision, 6) plan for and create short-term wins, 7) consolidate improvements and produce more change, and 8) institutionalize new approaches.\textsuperscript{265} To establish a sense of urgency in an unsupportive or unaware environment, I must first understand the cultural and academic milieu of the veterinary college or school.\textsuperscript{265} There are several key questions must be asked (and answered) in order to avoid underestimating the difficulty of implementing a new course/training program within an already established curriculum: 1) Has the college recently undergone a curricular revision? 2) When was the college’s last accreditation visit from the AVMA COE? 3) What was the outcome of the last accreditation visit and self study report? 4) Are there unrealized opportunities within the college’s current curricular structure that would allow for adaptation and implementation of a VCR program?

Key players to engage in the conversation regarding the urgent need for disaster training within a college’s professional veterinary core curricula would be the administration (Deans, Department Heads or Chairs), the curriculum committee, faculty course coordinators, staff (particularly within departments of population or public health) and student leadership. Answers to these questions will help create and frame the appropriate vision and implementation strategy for a new VCR program at each college.
Once this vision is created, in order to establish a sense of urgency, it is important for me to convince at least 75% of the key players that the VCR program is essential in building OH capacity. Using recent examples of disaster scenarios and crisis situations and a compelling vision of the impact and value of the VCR program, I will establish a sense of urgent at each of the institution.

Next, a powerful guiding coalition must be formed. In order to form this coalition to steer and champion the VCR program, I must bring together a group of academics, governmental officials, and nongovernmental agents that share a commitment and understanding of an OH disaster training and emergency management program. It is imperative that this guiding coalition have strong teamwork/teambuilding skills and influence with or access to people within power to evoke or lead change. Once the coalition of advocates and champions has been established, the VCR program’s vision must be communicated. It is imperative that I (and my guiding coalition) can clearly convey the program’s relevance and value to the academic leadership within the veterinary medicine and that the vision is brief, repeatable, and easy to understand. A vision statement for the VCR program is summarized below:

Our ability to meet the collective health challenges that we face today will require a collaborative effort that transcends the current predominant disciplines. Within both our veterinary and human health professions, there is an urgent need to build capacity in emergency management and disaster preparedness. Post-professional training is often too late to optimally capture the interest and energy of a sufficient number of individuals necessary to fully address the gaps in our current public service, emergency management, and especially our volunteer workforces. As a result, veterinary professional students require additional foundational and experiential components during their formative training to fully prepare them to address the complex issues in disaster preparedness and management. A new paradigm in public health and disaster preparedness requires the integration of a broad set of skills, knowledge, and competencies that span disciplines and
necessitates close partnership between governmental agencies, non-governmental organizations and academia. The VCR program provides cross-disciplinary training necessary for veterinary students to plan for, and respond to, disasters holistically to achieve entry-level federal credentials in emergency response which is imperative to more fully address the scope and depth of the world’s global health problems in times of crisis.

Once the VCR program’s vision is clearly communicated and understood, I must also establish an implementation strategy that is flexible and empowers others to act on the vision. There are three main methodologies to begin this effort of applying and adapting the VCR program within professional DVM training programs: 1) I will freely provide and distribute the curricular content of the VCR program to all the veterinary colleges and schools nationwide, 2) I (and my guiding coalition) will train and support all faculty which choose to utilize the VCR program and ask for assistance, and 3) I will develop and distribute a high quality online version of the VCR program through the Veterinary Internet Content Exchange (Vet ICE), which is a cooperative internet course exchange for veterinary colleges and schools, open to all AAVMC member institutions, that provides faculty and students access to high-quality, internet-based learning materials and courses in a variety of animal health disciplines.

In order to support and encourage national implementation of the VCR program, I must create short term wins. Curricular change on a national level requires positive momentum and financial backing. There are several granting agencies (most notably FEMA and USDA) and corporate and professional foundations (including the AVMF) that could provide funding in preparedness (non-disaster) grants. In addition to seeking out financial support, I must also provide visible rewards for participating faculty and colleges.
Therefore, I intend to form a national VCR Program Taskforce (VCRPT, similar to the HCPT of Case History 4 in Chapter 2), which will recognize and support faculty and administrative leadership contributing to educating veterinary students in disaster preparedness and emergency management.

Finally, I must consolidate programmatic improvements and produce more change by using the increased credibility from successful grant writing and the prominence and recognition of the VCRPT. The application of Normalization Process Theory, as discussed in Chapter 2, which focuses on embedding of an organizational change as routine practice and targets the conditions of use and behavior of everyday users rather than an innovation’s specific champions or early adopters will assist me in the broad institutionalization of the VCR program. In order to disseminate the VCR program nationwide and specifically meet local situations and requirements at each college and university, I must be flexible and willing to reconfigure and modify the VCR program and its modules. For example, I fully expect that national implementation will require the creation of new tabletops scenarios and inclusion of specific response information to fully embrace a relevant all hazards response in the various regions of our country.

**Conclusions**

In the search for solutions to global health problems, an OH perspective is vital. Nowhere is the concept of OH more applicable than in disasters or crisis situations. When a disaster strikes, the connections between people, animals and the environmental health become clear. They (we) are inextricably combined.
Therefore, it is essential that veterinarians understand that, in addition to their functions as animal health care providers, they are an essential part of a complex and interactive health system with responsibilities to also protect and improve the well-being of human and the environment. It is evident that OH is a recognizable concept in the professional training of veterinarians and that it is possible to structure a course around this important human-animal-environmental intersection. Furthermore, the VCR program is an ideal example of a vehicle for OH principles to be diffused into a training curriculum. It stands as a model for what OH training can be for the health professions.
<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>CONTENT AGENDA</th>
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| **Day 1** | • Impact of Natural Disasters on Public Health  
• Table Top Scenario: Natural Hazard  
• Multiuse Emergency Management Planning  
• Major Public Health Functions in Disasters  
• Legal Authority and Responsibility of the Public Health Officer  
• Standardized Emergency Management System and Operational Areas  
• Public Health ICSTable Top Scenario: Naturally Occurring Disease O |
| **Day 2** | • Disease Outbreak Versus Natural Disasters  
• Bioterrorism 101  
• Scenario Exercise: Chemical/Radiological Terrorism Event  
• Bioterrorism Versus Other Outbreaks  
• Public Health’s Role in Bioterrorism  
• Integration of Public Health Into Local Emergency Management  
• Coordination With Hospitals and Healthcare Providers  
• Scenario Exercise: Bioterrorism Event |
Appendix 2. An Overview of Topics and Revised Topics for “Leadership in Disaster Response,” Texas A&M College of Medicine, 2003–04 and 2004–05 (Parrish et al. Academic Medicine, Vol. 80, No. 9 / September 2005)\textsuperscript{208}

Day 1
Introduction to Disaster Medicine (L)
Trauma and Disaster Epidemiology (L)
Regional Trauma System (L)
Introduction to Disaster Medicine (L)
Chemical Agents (L)

Day 2
Refugee Scenario (SG)
Public Health (L)
Communicable Disease (L)
Legal Issues in Disaster Response (L)
Handling the Media (L)
Bacterial Agents of Bioterrorism (L)
Environmental Threats (L)
Radiation (L)

Day 3
Triage Principles (L)
Biological Weapons (L)
Chemical Weapons (L)
Nuclear Weapons (L)
Public Health Case-Based Scenario (PBL)
Bioterrorism and Public Health (L)
Legal Aspects of Disaster Response (L)
Public Health Case-Based Scenario (SG-PBL)

Day 4
Blast Injuries (L)
Crush Syndrome (L)
Psychiatric Aspects of Disaster Response (L)
Refugee Scenario (SG)
Global Health/Communicable Disease (L)
Triage Principles (L)
Psychiatric Aspects of Disaster Response (L)

This is a required course for second-year students. The course content was revised based on student and faculty evaluations after the 2003–04 course was completed.

L = lecture; SG = small-group format; PBL = problem-based-learning format.
I. Emergency Management and Preparedness
1. Disaster Phases: List and describe the different phases of disasters.
2. Hazards Risk Assessment and Planning: Explain the concepts and describe selected methods of hazards risk assessment and all-hazards planning.
3. Response Functional Roles: Explain the concepts of and describe functional response roles for one’s profession, health agencies, and community members.
4. Incident Command: Explain the concept of an ICS and describe its functional components.
5. Integration with Emergency Management: List and describe the members of the local emergency management system and describe one’s role within it.
6. Communication: Explain the concepts of risk communication and describe the procedures for reporting possible disasters.
7. Governmental Resources and Authorities: List the governmental resources and outline the regulatory issues associated with emergency management and response.
8. Preparedness Evaluation: Describe evaluation activities such as table-top drills.

II. Terrorism and Public Health Emergency Preparedness
1. Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) Agents: List the major classes of weapons and prevention strategies for each of them.
2. Biological: List the Category A biological agents and describe their epidemiology, associated illnesses, and treatments; list the Category B agents.
3. Chemical: List the major classes of chemical agents associated with potential terrorist activity and describe their routes of exposure, associated illnesses, and treatments.
4. Radiological/Nuclear: List the types of radiation associated with potential terrorist activity and describe their routes of exposure, associated illnesses, and treatments.
5. PPE: Describe the principles of and demonstrate the ability to select appropriate PPE.

III. Public Health Surveillance and Response Systems
1. Principles and Practice of Surveillance: List and describe the principles and procedures of surveillance and surveillance systems.
2. Public Health Interventions: List and describe the public health interventions that are part of a response to surveillance signals.

(Additional competencies for clinical personnel)

IV. Patient Care for Disasters, Terrorism, and Public Health Emergencies
1. History: Demonstrate the ability to take medical histories that identify symptoms associated with exposure to CBRNE agents.
2. Physical Examination: Demonstrate the ability to conduct physical examinations that identify signs associated with exposure to CBRNE agents.
3. Differential: Demonstrate the ability to consider exposure to CBRNE agents when establishing differential diagnoses and developing problem lists.
4. Diagnosis: Demonstrate the ability to rule out, when possible, or determine an accurate diagnosis of exposure to CBRNE agents.
5. *Procedures and Laboratory Tests:* Demonstrate the ability to incorporate evidence-based diagnostic procedures and laboratory studies to confirm the diagnoses and/or causative agents.

6. *Pharmaceutics:* Knowledge of the pharmaceutics and pharmaceuticals used to combat CBRNE agents (e.g., burn therapies, biochemical antidotes, antibiotics, vaccines).

7. *Treatment:* Within the scope of one’s professional practice, initiate physiological and psychological interventions for treatment of biological, chemical, radiological, and mass trauma injuries.

8. *Identification of Incident Stress Reaction:* Identify the signs and symptoms of acute or delayed critical incident stress reaction among community members or responders.

9. *Treatment of Incident Stress Reaction:* Demonstrate familiarity with a range of resources to address acute or delayed critical incident stress reactions among community members or responders.

10. *Forensics:* Demonstrate the ability to recognize the need for, and to collect and preserve, forensic evidence from patients who may be victims of a CBRNE event.

* These competencies were developed in 2004 by experts from the four health professions schools of Columbia University.
Appendix 4. Tasks that applicants for veterinary accreditation are expected to be able to perform (From, Wenzel, et al., JAVMA, Vol. 230, No. 9, May 1, 2007)

1. Perform physical examinations of individual animals and visually inspect herds or flocks to determine whether the animals are free from any clinical signs suggestive of communicable disease.
2. Recognize the common breeds of livestock so as to be able to record breed information on official documents.
3. Recognize brucellosis tattoos and calfhood vaccination tags and determine the state of origin of eartags to properly identify animals in interstate commerce.
4. Estimate the age of livestock by means of a dental formula.
5. Apply an eartag, tattoo, backtag, and legband.
6. Certify the disease status of a poultry flock with regard to diseases such as salmonellosis, chlamydiosis, and exotic Newcastle disease by evaluating records of the flock’s participation in federal and state poultry health programs.
7. Properly complete certificates for domestic and international movement of animals.
8. Apply and remove official seals.
9. Perform a necropsy on livestock.
10. Recognize clinical signs and lesions of exotic animal diseases.
11. Plan a disease control strategy for a livestock unit.
12. Vaccinate for brucellosis and fill out the vaccination certificate.
13. Draw and ship blood for testing.
14. Perform a caudal fold test for tuberculosis.
15. Develop appropriate cleaning and disinfection plans to control the spread of communicable disease in livestock.
16. Explain basic principles for control of diseases, such as brucellosis, pseudorabies, and tuberculosis, for which Animal and Plant Health Inspection Service and state cooperative control programs exist.

1. Demonstrate active listening skills.
2. Prioritize and respond to human needs.
3. Recognize and provide information on mild psychological and behavioral reactions.
4. Recognize and provide information on potentially incapacitating psychological and behavioral reactions.
5. Teach acute stress management techniques.
6. Recognize and reduce risk factors for adverse outcome associated with intervention.
7. Recognize how and when to use informal and formal resources for interpersonal support as well as how and when to refer to more formal mental health care.
8. List techniques that constitute effective self-care.
Appendix 6. Twenty-one Competencies for the Twenty-First Century

1. Embrace a personal ethic of social responsibility and service.
2. Exhibit ethical behavior in all professional activities.
3. Provide evidence-based, clinically competent care.
4. Incorporate the multiple determinants of health in clinical care.
5. Apply knowledge of the new sciences.
6. Demonstrate critical thinking, reflection, and problem-solving skills.
7. Understand the role of primary care.
9. Integrate population-based care and services into practice.
10. Improve access to health care for those with unmet health needs.
11. Practice relationship-centered care with individuals and families.
12. Provide culturally sensitive care to a diverse society.
13. Partner with communities in health care decisions.
14. Use communication and information technology effectively and appropriately.
15. Work in interdisciplinary teams.
16. Ensure care that balances individual, professional, system and societal needs.
17. Practice leadership.
18. Take responsibility for quality of care and health outcomes at all levels.
19. Contribute to continuous improvement of the health care system.
20. Advocate for public policy that promotes and protects the health of the public.
21. Continue to learn and help others learn.
Appendix 7. The Council’s set of core competencies for public health professionals targeted at the mid level public health professional.

In refining and updating the Core Competencies, the Council focused on the “mid-tier” of public health workers – that is those workers with an MPH (or related degree) and 5 years of work experience or individuals not having a public health degree but having at least 10 years of public health or public health-related work experience. By changing verbs in each statement, developing a set for the lower and upper-tiers will be relatively straightforward.

Draft Core Competencies

Analytic/Assessment Skills

1. Describes the characteristics of a population-based public health problem
2. Triangulates quantitative and qualitative data
3. Selects variables that measure public health conditions
4. Develops the methods and instruments for collecting quantitative and qualitative data
5. References sources of public health data and information
6. Evaluates the integrity and comparability of data
7. Identifies gaps in data sources
8. Applies ethical principles to the collection, maintenance, use, and dissemination of data and information
9. Makes community-specific inferences from quantitative and qualitative data
10. Interprets information with regard to risks and benefits to the community
11. Applies data collection processes, information technology applications, and computer systems storage/retrieval strategies
12. Utilizes data to address scientific, political, ethical, and social public health issues.

Policy Development/Program Planning Skills

1. Analyzes information relevant to specific public health policy issues
2. Writes policy statements
3. Determines the feasibility and expected outcomes of policy options
4. Articulates the health, fiscal, administrative, legal, ethical, social, and political implications of policy options
5. Utilizes decision analysis in the process of health planning
6. Manages public health programs consistent with its public health laws and regulations
7. Develops a plan to implement policy.
8. Implements policy into organizational plans, structures, and programs
9. Develops mechanisms to monitor and evaluate programs for their effectiveness and quality
10. Incorporates public health informatics practices
Communication Skills

1. Communicates in writing and orally in person and through electronic means.
2. Communicates with linguistic and cultural proficiency
3. Solicits input from individuals and organizations
4. Utilizes a multimedia approach to disseminate public health information
5. Presents demographic, statistical, programmatic, and scientific information for professional and lay audiences
6. Applies communication strategies, including principled negotiation, conflict resolution, and active listening in the interactions with individuals and groups
7. Implements the public health agency’s communication policies and procedures

Cultural Competency Skills

1. Incorporates strategies for interacting with persons from diverse cultural, socioeconomic, educational, racial, ethnic and professional backgrounds.
2. Considers the role of cultural, social, and behavioral factors in determining the delivery of public health services
3. Responds to problems that are the result of cultural differences
4. Explains the dynamic forces that contribute to cultural diversity
5. Describes the need for a diverse public health workforce
6. Assesses the public health agency for its cultural competence

Community Dimensions of Practice Skills

1. Assesses the community from an ecological perspective
2. Collaborates in community based participatory research efforts
3. Establishes linkages with key stakeholders
4. Facilitates collaboration with internal and external groups to ensure participation of key stakeholders
5. Uses group processes to advance community involvement
6. Maintains partnerships over time
7. Describes the role of government, the private sector and non profit sectors in the delivery of community health services
8. Negotiates for the use of community assets and resources
9. Advocates for public health policies, programs, and resources

Public Health Sciences Skills

1. Describes the scientific underpinnings of the field of public health
2. Identifies the prominent events in the history of the public health profession
3. Relates the public health science skills to the core public health functions and the ten essential services
4. Applies the basic public health sciences to the prevention of chronic diseases, infectious diseases, injuries, and other population-based health threats
5. Conducts a comprehensive review of the scientific evidence related to a public health issue, concern, or, intervention
6. Assesses the health status of populations and their related determinants of health and illness, including the factors contributing to health promotion and disease prevention, and the use of health services
7. Retrieves scientific evidence from a variety of text and electronic sources
8. Determines the limitations of research findings
9. Describes the importance of research observations and interrelationships among these findings
10. Implements the requirements of HIPAA, IRB, patient confidentiality, and human subject processes
11. Contributes to the building the scientific base of public health

**Financial Planning and Management Skills**

1. Manages public health programs within the historical development, structure, and relationship of state and federal public health and health care systems
2. Manages public health programs within the structure, function, and jurisdictional authority of the organizational units within federal, state, and local public health agencies
3. Develops partnerships with other agencies within the federal, state, and local levels of government that may have associational authority with public health under certain situations or with specific issues, such as an emergency event.
4. Implements the judiciary and operational procedures of the administrative body(s) that oversees the operations of the public health agency
5. Develops a programmatic budget
6. Manages programs within current and forecasted budget constraints
7. Develops strategies for determining budget priorities
8. Evaluates program performance
9. Prepares the narrative and fiscal components of proposals for funding from external sources
10. Applies basic human relations skills to the management of organizations, motivation of personnel, and resolution of conflicts
11. Applies public health informatics skills to streamline program operations program operations and business operations
12. Negotiates contracts and other documents for the provision of services
13. Utilizes cost-effectiveness, cost-benefit, and cost-utility analyses in the programmatic prioritization and decision making.

**Leadership and Systems Thinking Skills**
1. Incorporates ethical standards of practice as the bases of interactions with organizations and communities
2. Incorporates systems thinking into public health practice
3. Participates with stakeholders in identifying key values and a shared vision as guiding principles for community action
4. Rectifies internal and external problems that may affect the delivery of essential public health services
5. Sponsors team and organizational learning opportunities
6. Contributes to the measuring, reporting and improvement of organizational performance
7. Modifies public health practice in concordance with changes in the larger social/political environment
8. Establishes mentoring, peer advising, coaching or other personal development opportunities for newer public health workers
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