
Applying Educational Gaming to Public Health Workforce Emergency Preparedness

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Abstract: From natural disasters to terrorism, the demands of public health emergency response require innovative public health workforce readiness training. This training should be competency-based yet flexible, and able to foster a culture of professional and personal readiness more traditionally seen in non-public health first-response agencies. Building on the successful applications of game-based models in other organizational development settings, the Johns Hopkins Center for Public Health Preparedness piloted the Road Map to Preparedness curriculum in 2003. Over 1500 employees at six health departments in Maryland have received training via this program through November 2004. Designed to assist public health departments in creating and implementing a readiness training plan for their workforce, the Road Map to Preparedness uses the core competencies of the Centers for Disease Control and Prevention for all public health workers as its basic framework.

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Introduction

Since the terrorist attacks of 2001 in the United States, the federal government has moved toward an all-hazards model of public health emergency readiness. In this approach, health departments must be able to respond efficiently to a broad spectrum of intentionally caused and naturally occurring large-scale emergencies that have an impact on the public's health. The Institute of Medicine¹ has stated that preparation for the threat of terrorism requires a full public health response, and quantitative research on earthquake survival rates reveals the critical importance of public health and health sector preparedness in natural disaster response.²

From terrorism to natural disasters, the all-hazards model of public health preparedness requires that health department employees be trained, ready, and willing to respond to emergencies at nontraditional hours. However, developing an organizational culture of emergency readiness remains a significant challenge for public health, traditionally accustomed to a 9-to-5 mode of operation, in contrast to its counterparts in fire protection, law enforcement, and emergency medical services. To compound this challenge, the perception of change as an "unknown, unpredictable, and unsafe" phenomenon plays on the vulnerabilities of

many individuals.³ Organizational change can be a difficult process fraught with resistance and/or outright failure.⁴

An essential step in facilitating organizational change entails anticipating and addressing barriers to change.⁵ Through informal discussions with public health employees in the mid-Atlantic region, the Johns Hopkins Center for Public Health Preparedness has identified specific barriers to adopting an emergency response culture in local health departments. These barriers include public health employees' fear for their personal and family safety in emergencies, coupled with a lack of insight into how valuable they are to crisis response efforts.

Competency-based public health training has been found to have a positive impact on public health employee readiness and response knowledge and attitudes.⁶ The Centers for Disease Control and Prevention (CDC) has adopted a series of bioterrorism and emergency readiness competencies for all public health workers, developed by Columbia University School of Nursing and Health Policy.⁷

As Gebbie and Merrill⁸ describe, the development of "valid, useful, and acceptable" preparedness competencies involved a multipart process, including drafting competencies through literature review and consultation by emergency preparedness and public health experts; expanding and validating these draft competencies using the Delphi method (a qualitative research method that establishes consensus among experts through successive rounds of survey-based feedback); and confirmation of these competencies through focus groups with public health practitioners.

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Despite the benefits of competency-based training,⁶ guidance for health departments on best practices for training their employees in these preparedness competencies has lacked clear definition and standardized direction. The introduction to the nine CDC core competencies for all public health workers notes that “initial orientation to these competencies can be done in a general way” and “can be interpreted with varying levels of complexity.”⁷ Already faced with limitations in training budgets, personnel resources, and time, health departments need additional guidance for creating a resource-efficient, systematic all-hazards training approach that (1) addresses CDC’s core readiness competencies for all public health workers,⁷ and (2) provides sufficient flexibility to accommodate the unique response demands and vulnerabilities of individual health departments.

This may require innovative training and organizational development methods to enhance preparedness skills, and create a culture of organizational readiness among public health workers through a process of “syntonic” organizational change.³ In the syntonic model, organizational change is a nonthreatening, natural growth process that is more likely to be embraced by employees than resisted; key factors in syntonic change include anticipatory guidance and experiential learning.³ To be consistent with syntonic organizational change, health department preparedness curricula should reflect a nonthreatening motivational approach that includes experiential learning. In addition to teaching competency-based factual information, preparedness curricula must also foster appropriate attitudinal “buy-in” from public health employees about their new professional readiness duties.

Background on the Educational Theory of Gaming

Gaming—the use of games as training tools—can facilitate the learning of cognitive, affective, and psychomotor skills and knowledge.⁹ Introduced as an educational approach over 75 years ago by Dewey and the Gestalt theorists,¹⁰ gaming offers some distinct training advantages over more traditional didactic methods; as Henry¹¹ points out, games link theory to reality and provide a forum for immediate feedback. Educational gaming can involve simulation, but does not necessarily have to do so to promote learning: Nonsimulation fact-based review games have been used in nursing education to reinforce clinical knowledge on subjects ranging from the cranial nerves¹² to blood clots.¹³ As an adult learning methodology, gaming can build enthusiasm among participants¹⁴ and encourage positive interactions among individuals with diverse learning and communication styles.¹⁵

Gaming is consistent with the syntonic model of organizational change, as training games can incorporate experiential learning to have an impact on knowl-

edge and attitudes in a nonthreatening way. The nursing education literature, for example, describes the experiential learning value of simulation games to build cognitive knowledge (content games) and affective knowledge (process games).¹⁶ Experiential learning—learning by doing—is already an integral part of most medical professionals’ formal training. Studies comparing attitudes of learners in a traditional didactic lecture setting versus an experiential learning situation show that students’ attitudes are significantly more positive about the subject matter in experiential settings.^{17,18,19} The nonthreatening nature of gaming as a training tool allows learning to occur in a safe environment without fear of real-world adverse outcomes.¹¹

Through these various applications, gaming provides trainees with time-efficient, intrinsically motivating learning opportunities for promoting organizational development in a variety of ways, including teaching management skills, conveying information, providing an appreciation for the complexity of organizational decision making, allowing trainees to experience the consequences of organizational decisions, and realizing the importance of interpersonal processes.²⁰

Gaming and Public Health Workforce Training

Training games in the form of disaster scenario-based tabletop, functional, and full-scale readiness exercises have been a mainstay of federal, state, and local public health emergency readiness efforts, particularly since the terrorist attacks on the United States in 2001. While these exercises do not necessarily explicitly evolve from gaming theory per se, they are nonetheless consistent with the concept of gaming as a nonthreatening learning tool that can involve simulation. In the process, readiness exercises put written agency plans into action, thus overcoming what Perry and Lindell²¹ describe as a “tendency to equate emergency planning with the presence of a written plan and similarly believe that a written plan is evidence of jurisdictional preparedness.” The explicit application of gaming principles has been successful in developing role-specific leadership skills in public health; for example, Byalin²² employed gaming as a conceptual model for enhancing leadership skills for managers of public mental health systems.

Building on these successful educational applications of gaming in public health, we believe that a gaming-based curriculum model can enhance all-hazards workforce preparedness in public health agencies. Integrating group- and individual-level learning through a stepwise sequence of exercises and trainings, this model can develop public health employees’ core readiness competencies. Through a systematic incentive-based, agency-wide training approach, this curriculum can also serve an important team-building function to build

Table 1. Core readiness competencies for all public health workers and corresponding Road Map to Preparedness activities

Bioterrorism and emergency readiness: core competencies for all public health workers⁷	Corresponding Road Map to Preparedness activities
1. Describe public health role in emergency response in a range of emergencies that might arise.	Learn about public health role in emergency response. Take Columbia online course ²⁴ or equivalent.
2. Describe chain of command in emergency response.	Using templates provided by your agency, write your name in proper place in your agency's incident command system chain of command.
3. Identify and locate agency emergency response plan.	Identify and locate health department's emergency response plan or section relevant to your role.
4. Describe his/her functional role(s) in emergency response and demonstrate his/her role(s) in regular drills.	Participate in a training session about what your specific primary and alternate roles would be during an emergency, and why it is important to success of the effort. Identify limits to your own authority.
5. Demonstrate correct use of all communication equipment used for emergency communication.	Demonstrate use of communication equipment.
6. Describe communication role(s) in emergency response: Within the agency using established communication systems With the media With the general public Personal (with family, neighbors)	Attend an agency-sponsored lecture, "How to Talk to People about Disasters" Participate in communication practice session and practice the skills learned during the risk communication lecture, or make a presentation to others about how to talk to people about disasters. Describe your risk communication roles within the agency, with the media, with the general public, and with family/personal contacts.
7. Identify limits to own knowledge/skill/authority, and identify key system resources for referring matters that exceed these limits.	Participate in a training session about what your specific primary and alternate roles would be during an emergency, and why it is important to the success of the effort. Identify limits to your own authority.
8. Recognize unusual events that might indicate an emergency and describe appropriate action.	Participate in agency-led discussion to explore what kinds of unusual events or trends might indicate an emergency or disaster, and describe appropriate actions.
9. Apply creative problem solving and flexible thinking to unusual challenges within his/her functional responsibilities and evaluate effectiveness of all actions taken.	Participate in a training session about weapons of mass destruction and appropriate public health response activities. Participate in exercise/training in which you demonstrate creative problem solving to unusual challenges.

a much-needed culture of emergency readiness in health departments.

The Road Map to Preparedness: History and Overview

To address the educational needs and overcome organizational culture-change barriers to readiness among the public health workforce, Johns Hopkins Center for Public Health Preparedness piloted the Road Map to Preparedness curriculum in 2003.²³ Designed to assist public health departments in creating and implementing a readiness training plan for their workforce, the Road Map uses CDC's nine emergency preparedness core competencies for all public health workers⁷ as its basic framework. Combining agency-led group activities and self-study activities, the Road Map to Preparedness is an incentive-based training tool that incorporates the principles of learning through gaming.

To date, >1500 employees from six different health departments in Maryland have received training using

the Road Map to Preparedness. Recruitment and awareness for this program have developed primarily via word-of-mouth networking through the Maryland Association of County Health Officers, and via meetings with a Maryland Department of Health and Mental Hygiene-sponsored bioterrorism preparedness coordinators' working group. These Road Map training activities are currently funded by the Johns Hopkins Center for Public Health Preparedness grant from CDC, thus defraying training costs for participating health departments.

The Road Map to Preparedness consists of a series of 15 activities, laid out on a game board, with a corresponding curriculum for each "activity" along the board. Each employee is given his or her own Game Board and Road Map to Preparedness Key, along with a packet of supporting materials. The activities along the board are based on a combination of core public health competencies and the nine core CDC preparedness competencies for all public health workers (Table 1).⁷ In addition to these core competencies, some of

Table 2. Additional Road Map to Preparedness activities for addressing public health organizational readiness challenges

Organizational readiness challenge	Road Map to Preparedness activity
Promoting worksite safety and security in emergencies	Describe how you are participating in the planning and implementation of a plan at your worksite, to ensure the safety and security of staff and clients in the event of an emergency.
Enhancing personal and family emergency preparedness	Write out your own personal and family emergency response plan. Include enough detail that someone else looking at your plan would be able to follow it accurately. Share the plan with your family and everyone involved in carrying out your plan.
Facilitating capacity to report to duty in a crisis	Draw a map showing how you would get from your home to your designated emergency assignment location(s). Plan three different routes in case unexpected street closures obstruct your way. Indicate ways in which you will be notified in the event of an emergency.

the activities included in the Road Map to Preparedness are designed to facilitate syntonetic organizational culture change, by influencing the way public health employees think about their jobs and feel about their roles in emergency response (Table 2).

In line with its incentive-based approach, a series of rewards is offered for employees who successfully complete predetermined segments of the Road Map to Preparedness. These external rewards are provided at the discretion of participating health departments and have included, for example, specified amounts of administrative leave time awarded on completion of designated Road Map activities within a given timeframe. Byalin²² describes the process of “accessing external rewards” as a welcome form of “payoff” in gaming-based organizational developmental efforts, as service-based bureaucracies like public health typically “offer line workers as well as supervisors and managers little positive reward for achieving goals.”

The format and content of each Road Map activity can be tailored to meet the unique needs of any health department, while still ensuring that each employee successfully completing the Road Map has achieved all nine CDC-adopted emergency preparedness core competencies for all public health workers.⁷

Gaming and the Road Map to Preparedness

Through its participatory and incentive-based approach, the Road Map aims to facilitate employees’ buy-in to the emergency preparedness components of their professional roles in public health. By encouraging individual-level and agency-wide journeys toward readiness, the Road Map is designed to foster organizational syntonetic culture change from a 9-to-5 workplace to a 24/7-ready agency. The opportunity for friendly competition in the Road Map game enhances its use as a motivational tool. Some participating health departments, for example, have placed an enlarged Road Map Game Board in a central location and kept track of their agency divisions’ progress, often in friendly competition among sections or departments.

In its gaming-based structure, the Road Map also incorporates the tenets of experiential learning. Six of

the 15 activities on the Road Map directly apply experiential learning strategies to enhance organizational readiness (Activities 7, 8, 9, 12, 14, and 15). Three of these six activities (Activities 7, 8, and 9, respectively) are individually based, focusing on personal/family emergency preparedness, transportation to work in emergencies, and functional knowledge of communications equipment. The other three experiential learning activities on the Road Map (Activities 12, 14, and 15, respectively) are group oriented, and address risk communication, creative problem solving, and collaborative organizational response. The remaining nine activities on the Road Map involve more traditional classroom or online didactic learning activities, such as introduction to preparedness against biological, chemical, and radiologic weapons of mass destruction.

Summary of Road Map to Preparedness Activities and Evaluation Tools

In its stepwise approach, the Road Map is designed to develop and reinforce readiness and response knowledge, skills, and attitudes among all health department employees. The first two activities on the Road Map address foundational preparedness knowledge and competencies, by requiring completion of the Columbia University Mailman School of Public Health online preparedness course²⁴ or equivalent (Activity 1) and an introductory training on intentional threats to the public’s health (Activity 2).

To address health department workers’ concerns about personal and family safety in a disaster, the curriculum emphasizes personal and family preparedness training as a cornerstone of successful public health emergency response. Activity 7 requires participants to attend an agency-sponsored lecture on personal/family readiness, and then to develop their own individualized personal/family emergency response plans following U.S. Department of Homeland Security guidelines.²⁵ In order to reinforce personal readiness in the workplace, Activity 4 involves participants in developing and implementing a worksite plan to ensure safety and security in an

emergency. Activity 8 requires participants to map out their primary and alternate routes from home to their respective emergency assignment locations.

Three activities on the Road Map focus on role-specific emergency response tasks for employees. Activity 3 involves participating in a preparedness training that focuses on individual employees' specific primary and alternate roles during an emergency, and that familiarizes them with the respective limits to their own authority. Activity 5 asks each employee to identify his or her place on their agency's incident command chart. Activity 6 requires employees to identify and locate their health department's emergency response plan.

The Road Map curriculum addresses the critical need for effective emergency communications skills and protocols in public health departments through four activities. These include Activity 9 (demonstrate the use of communication equipment per a checklist); Activity 10 (indicate ways in which you will be notified in the event of an emergency); Activity 11 (attend an agency-sponsored lecture on risk communication); and Activity 12 (participate in a communication practice session, describing your communication roles).

Rapid emergency recognition and creative problem-solving are essential readiness skills. Accordingly, Activity 13 requires participation in an agency-led discussion on emergency recognition and response, and Activity 14 asks employees to participate in an exercise training focusing on creative problem solving.

As a culmination to the Road Map, an agency-sponsored exercise (Activity 15) incorporates the skills and knowledge developed in Activities 1 to 14 of the Road Map. This exercise can range in complexity from a tabletop to a live full-scale exercise, depending on the resources and needs of individual health departments.

A companion evaluation tool to the Road Map to Preparedness includes a variety of functional preparedness assessment activities, such as unannounced performance quizzes that require employees to demonstrate readiness competencies based on previously completed Road Map trainings. These functional pop quizzes can range from demonstrating the use of a two-way radio in a hypothetical scenario, to responding appropriately to a simulated phone call from a local emergency room reporting a suspicious rash on a patient. Anonymous employee self-assessments of their performances in follow-up tabletop, functional, or full-scale exercises also reflect this emphasis on experience-based evaluation metrics.

Future Applications and Assessments of the Road Map to Preparedness Game

Public health department staff turnover and other ongoing training needs will create further opportuni-

ties to modify the Road Map to Preparedness. Specific trainings for more specialized emergency response activities—such as media-based crisis risk communication, epidemiologic investigation, or Strategic National Stockpile management—can be easily added to the Road Map requirements for specific groups of employees, incorporating experiential learning techniques.

Future potential applications of the Road Map can occur in non-public health governmental agencies whose employees may be needed to augment public health response clinic and emergency shelter operations in affected communities during a disaster. Additionally, a Road Map version for employees in large and small businesses is currently in development to provide a systematic approach to emergency readiness training in the private sector.

Public health workforce readiness training is a required component of CDC-funded terrorism preparedness activities at state and local health departments. As a recently introduced training model, the Road Map will require further evaluation to develop a cost-benefit profile of its resource requirements (primarily time and personnel) versus its impact as a training tool (developing preparedness knowledge, skills, and attitudes among public health workers).

A primary goal of the Road Map is to remove barriers to employees' participation in emergency response operations. Future evaluations will focus on the Road Map's impact on public health workers' ability and willingness to report to duty in a crisis. This can be gauged through data on employee participation rates in exercises and actual events at health departments that have completed the Road Map to Preparedness. After-action assessments and supervisor evaluations from exercises and real-world events can be used to evaluate a variety of potential effects of the Road Map training intervention on emergency response, including decision making, situational awareness, communication and coordination, stress management, and teamwork.

Upcoming assessments of the Road Map to Preparedness game will also focus on its flexibility to meet the distinctive preparedness needs of health departments in urban versus rural settings. In the next two calendar years, implementation of the Road Map to Preparedness is planned in Delaware and in >20 county health departments in Maryland, ranging from rural communities to densely populated urban centers. Data from participating health departments will provide invaluable perspectives on health department employees' perceptions of the Road Map's relevance to their communities' unique vulnerabilities. An important evaluative feature of this model's flexibility will be its cultural competency in meeting the readiness needs of a diverse public health workforce.

As the Road Map to Preparedness evolves as a gaming tool, subsequent evaluations will assess the Road Map's impact on everyday work performance. A number of the skill sets developed on the Road Map are transferable to

nonemergency settings. These include risk communication, use of communication equipment, and creative problem solving. Additionally, the Road Map's effectiveness as a team-building experience may positively impact group dynamics at an agency in day-to-day contexts. Focus groups and longitudinal surveys will help to ascertain the relevance of these skill sets to non-emergency-related job performance.

Future evaluation of the Road Map to Preparedness will also assess this game's short- and longer-term impacts on the public health practice community's preparedness behaviors and outcomes, and its relevance to evolving emergency preparedness needs and challenges through syntonetic organizational culture change.

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References

1. Butler AS, Panzer AM, Goldfrank LR. Preparing for the psychological consequences of terrorism: a public health strategy. Institute of Medicine, Committee on Responding to the Psychological Consequences of Terrorism Board on Neuroscience and Behavioral Health. Washington DC: National Academies Press, 2003.
2. Bissell RA, Pinet L, Nelson M, Levy M. Evidence of the effectiveness of health sector preparedness in disaster response: the example of four earthquakes. *Fam Community Health* 2004;27:193-203.
3. Everly Jr. GS "Syntonetic change": a mental health perspective on avoiding the crises associated with change in organizations. *Int J Emerg Mental Health* 1999;1:217-8.
4. Edmondson AC. Learning from failure in health care: frequent opportunities, pervasive barriers. *Qual Saf Health Care* 2004;13:3-9.
5. Armenakis AA, Harris SG, Mossholder KW. Creating readiness for organizational change. *Hum Relations* 1993;46:681-703.
6. Qureshi KA, Gershon RR, Merrill JA, et al. Effectiveness of an emergency preparedness training program for public health nurses in New York City. *Fam Community Health* 2004;27:242-9.
7. Columbia University School of Nursing Center for Health Policy. Emergency preparedness: core competencies for all public health workers, November 2002. Available at: <http://cpmcnet.columbia.edu/dept/nursing/institute-centers/chphsr/compbroch.pdf>. Accessed August 10, 2004.
8. Gebbie K, Merrill J. Public health worker competencies for emergency response. *J Public Health Manag Pract* 2002;8:73-81.
9. Hayes SK, Childress DM. Games galore. *J Nurses Staff Dev* 2000;16:168-70.
10. Hanna DR. Using simulations to teach clinical nursing. *Nurse Educ* 1991;16:28-31.
11. Henry JM. Gaming: a teaching strategy to enhance adult learning. *J Contin Educ Nurs* 1997;28:231-4.
12. Jones AG, Jaspersen J, Gusa D. Cranial nerve wheel of competencies. *J Contin Educ Nurs* 2000;31:152-4.
13. Wargo CA. Blood clot: gaming to reinforce learning about disseminated intravascular coagulation. *J Contin Educ Nurs* 2000;31:149-51.
14. Pennington J, Hawley P. Use of educational gaming to enhance theory learning. *J N Y State Nurses Assoc* 1995;26:4-6.
15. Gary R, Marrone S, Boyles C. The use of gaming strategies in a transcultural setting. *J Contin Educ Nurs* 1998;29:221-7.
16. Ulione MS. Simulation gaming in nursing education. *J Nurs Educ* 1983;22:349-51.
17. Pugsley KE, Clayton LH. Traditional lecture or experiential learning: changing student attitudes. *J Nurs Educ* 2003;42:520-3.
18. Bolan CM. Incorporating the experiential learning theory into the instructional design of online courses. *Nurse Educ* 2003;28:10-14.
19. Baker CM. Using problem-based learning to redesign nursing administration masters programs. *J Nurs Admin* 2000;30:41-7.
20. Wexley KN, Yukl GA. Organizational behavior and personnel psychology. Homewood IL: Irwin, 1977.
21. Perry RW, Lindell MK. Preparedness for emergency response: guidelines for the emergency planning process. *Disasters* 2003;27:336-50.
22. Byalin K. Managing to win: front-line leadership in public mental health settings. *Admin Policy Mental Health* 1989;16:191-9.
23. Johns Hopkins Center for Public Health Preparedness. Road Map to Preparedness. Available at: www.jhsph.edu/CPHP/road_map.html. Accessed November 30, 2004.
24. Columbia University Mailman School of Public Health Center for Public Health Preparedness. Emergency preparedness core competencies for all public health workers: an online course. Available at: <http://cds.osr.columbia.edu/bepcourse/test.asp>. Accessed September 21, 2004.
25. U.S. Department of Homeland Security. READY.GOV home page. Available at: <http://www.ready.gov/index2.html>. Accessed September 3, 2004.