The South Central Center for Public Health Preparedness Training System Model: A Comprehensive Approach

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SYNOPSIS

The South Central Center for Public Health Preparedness (SCCPHP) is a collaboration among the schools of public health at Tulane University and the University of Alabama at Birmingham and the state health departments in Alabama, Arkansas, Louisiana, and Mississippi. The SCCPHP provides competency-based training via distant delivery methods to prepare public health workers to plan for and rapidly respond to public health threats and emergency events. This article presents the training system model used by the SCCPHP to assess, design, develop, implement, and evaluate training that is both competency driven and practice based. The SCCPHP training system model ensures a standardized process is used across public health occupations and geographic regions, while allowing for tailoring of the content to meet the specific training needs of the workforce in the respective state and local health departments. Further, the SCCPHP training system model provides evidence of the reciprocal nature between research and practice needed to advance the area of emergency preparedness training and workforce development initiatives in public health.

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The South Central Center for Public Health Preparedness (SCCPHP) is a collaboration among the schools of public health at Tulane University and the University of Alabama at Birmingham and the state health departments in Alabama, Arkansas, Louisiana, and Mississippi.¹ The mission of the SCCPHP is to prepare the workforce to respond to public health threats and emergencies—biological, chemical, nuclear, radiological, or explosive—whether naturally occurring or due to terrorism and resulting in mass trauma. The SCCPHP provides competency-based training via distant delivery methods to prepare public health workers to plan for and rapidly respond to these public health emergency events.

Several program activities are carried out to ensure this workforce development initiative is successful. First, working with state and local health agencies, the SCCPHP identifies training needs in bioterrorism, infectious disease, and other public health threats and emergencies. Next, based on these needs, the SCCPHP develops relevant competency-based training. The SCCPHP also designs common methods for evaluating the effectiveness of the training, including impact on knowledge of specific competencies and increased capacity to respond. The SCCPHP training system model depicted in the Figure highlights the integrated process developed to execute program activities systematically and collaboratively.

Another important program activity is sharing model development and innovative approaches to increase the effectiveness of other related training initiatives and reduce duplication of effort. Thus, this report presents the SCCPHP training system model, including detailed descriptions of each component and the relationships among the compo-

nents that ensure a comprehensive approach for emergency preparedness training.

SCCPHP TRAINING SYSTEM MODEL

Training program activities for the SCCPHP were conducted according to an integrated instructional design system model (Figure). The model was developed in response to a call for more systematic approaches to workforce development initiatives that incorporate research from organizational development and educational technology, including instructional design.²⁻⁵

Adapted from a generic training system model,⁶ the SCCPHP training system model emphasizes the major components of instructional design, including assessing, designing, delivering, and evaluating training. The model is an integrated system with results from one phase influencing the next, so that a series of steps is followed when developing, implementing, and evaluating emergency preparedness training. This process begins with assessing the need for training, and based on this information, moves to developing instructional objectives specifying what is to be achieved in the training, which, in turn, provide input for designing, delivering, and evaluating the effectiveness of the training program.^{6,7}

As the Figure shows, the model is a closed-loop system. Information resulting from evaluation of training effectiveness is used to determine the extent to which the SCCPHP is successful in meeting its training goals (i.e., preparing public health workers to plan for and rapidly respond to public health events). This information, therefore, provides feedback necessary to modify training system features such as

Figure. The South Central Center for Public Health Preparedness (SCCPHP) Training System Model

reassessing training needs, revising course objectives, or altering the delivery method. The training system is continually evolving, with results used to continuously improve training and enhance the preparedness of the public health workforce.

Two key factors are particularly relevant for the SCCPHP training and undergird each of the components in the model. First, the training is competency based. At each step of the training process, the SCCPHP ensures that training is grounded in the emergency response and bioterrorism core competencies.^{8,9} Second, at each step, the system relies on input from practice partners. The SCCPHP is comprised of an academic/practitioner partnership and thus utilizes practice expertise in assessing, designing, delivering, and evaluating training. Therefore, a hallmark of the SCCPHP training system is input from practice partners to ensure the training is both competency-driven and practiced based.

The system model emphasizes the important components of training and how each step influences and guides the next component. It allows all the major stakeholders, including academics, practice partners, and funding agencies, to view the entire SCCPHP training process and gain a greater understanding of the outcomes. This is particularly important given that research has demonstrated that the major stakeholders tend to hold differing perspectives on the primary focus of the assessment, design, development, implementation, and evaluation of workforce development initiatives.⁴

The SCCPHP training process consists of four phases: assessment, training development, implementation, and evaluation.

Phase I: Assessment

A training needs assessment is well recognized as the fundamental building block of any training effort.^{7,10,11} Training needs can be defined as any current or anticipated performance deficiencies that can be addressed by training.¹² The assessment of training needs determines what should be included in the training and who should receive it.

Consistent with recommendations in the training literature, several factors were considered during the needs assessment process for the SCCPHP model.^{6,13} First, practice partners were consulted to identify the appropriate methodology (e.g., structured interviews, web-based questionnaires, etc.) for the respective state and local departments of health. Second, assessors selected multiple methods of collecting assessment information so that the disadvantages of one method were offset by the advantages of another. Additionally, cross samples of employees were used to reveal multiple perspectives of workforce needs for each health department. By gathering information from supervisors, managers, and employees representing the various occupational groups, a more accurate and thorough depiction of training needs was obtained. Last, the SCCPHP needs assessment process consisted of two separate but complementary levels of analysis—individual and organizational—to gain a more comprehensive understanding of training needs.^{11,14,15}

At the micro level, an individual analysis was conducted to gather information on the individual training needs of the public health workforce. The SCCPHP individual needs assessment focused on self-report measures of the capabilities

of the workforce with respect to the core competencies for emergency response and bioterrorism, including the criticality of these competencies for their work. The extent to which training would enhance these capabilities was also assessed to prioritize training needs at both the state and local levels. The individual level analysis allowed the SCCPHP to focus training efforts on the competency-based critical needs of the public health workforce in a particular region.

To complement results from the individual level analyses, an organizational analysis was also conducted. Organizational analysis is a macro-level examination of system-wide components of the organization that may affect a training program.⁷ Only recently has organizational analysis begun to play an integral part in the needs assessment process.^{3,10-12} However, training research has demonstrated that these factors are crucial to the success of the training program and should be identified early in the training process.^{14,16-18}

The SCCPHP organizational analysis focused on identifying the organizational factors influencing SCCPHP training. Organizational factors generally include both tangible (e.g., tools and equipment, supplies and materials) and intangible (e.g., communication, cooperation from others) aspects.^{19,20} In general, organizational factors can be classified as either facilitators or barriers. Organizational facilitators are aspects of the work environment that create an ideal working situation²¹ and support the training environment to positively influence training-related knowledge, behaviors, and outcomes. Organizational barriers, on the other hand, are characteristics of the workplace that inhibit or interfere with the individual's performance to negatively impact training-related outcomes and reduce the likelihood that training will be effective.²²⁻²⁴ Therefore, the SCCPHP organizational analysis encourages a broader-level understanding of the contextual factors that impact the effectiveness of the SCCPHP training in meeting the competency-based critical needs of the public health workforce.

Several needs assessment methods were developed. At the state level, two separate but related methods were created. The first was the Training Needs Assessment Workshop (TNAW).²⁵ This 2½-day workshop was designed to provide a systematic and interactive process that both enhanced the stakeholders' knowledge of the emergency response and bioterrorism core competencies^{8,9} and identified priority training needs statewide (by competency and staff category). Using small group and break-out sessions, quantitative and qualitative data were obtained during three iterative rounds for each competency. Training needs were prioritized through quantitative analysis of importance and feasibility criteria. Content analysis of training needs descriptions also produced prioritized categories for training needs. In addition, information was gathered to identify organizational factors, existing resources, and preferred training formats to support training initiatives. The TNAW included external partners with whom public health staff would interact during emergency and bioterrorism events. The TNAW was initially piloted with representatives of state partners, and based on their feedback, revisions were made to the preliminary instruments. The TNAW was implemented with the Arkansas Department of Health.

The second needs assessment method developed for state public health departments was the Training Needs Assess-

ment Questionnaire (TNAQ).²⁶ The TNAQ was designed in both printed and web-based versions. It was developed based on a questionnaire created in 1998 to assess training needs for public health core functions and essential services.²⁷ Respondents were asked to self-report frequency, level of confidence, and extent to which training would enhance various competency-related abilities and behaviors. In addition, information was gathered to identify organizational factors, existing resources, and preferred training formats to support training initiatives. A content validation and initial pilot study of the TNAQ was completed with the SCCPHP Steering Committee, which is comprised of representatives of state and local health departments. A subsequent field test was conducted with Arkansas Department of Health staff members and external partners. Full implementation of the web-based form was conducted with the Mississippi Department of Health.

Training needs assessment was also conducted with the New Orleans Department of Public Health.²⁸ Particular attention was given to emergency medical technicians (EMTs), environmental specialists, and nurses. Because of staffing and schedule constraints, the TNAQ and TNAW were deemed by the department as inappropriate needs assessment measures. Consequently, protocols for structured interviews and focus groups were developed and used. These protocols were similarly competency based and focused on both individual and organizational level analyses. Respondents were asked to indicate their most salient overarching training needs. In addition, knowledge, skills, and abilities (KSA) and task statements regarding priority training needs were gathered and content analyzed to validate the general training needs identified.

Together, results from these assessments provide a comprehensive depiction of state and local priority training needs as well as the organizational factors influencing training. These results then provide the basis for subsequent training development and evaluation efforts.

Phase II: Training development

To develop training content, training needs must be translated into training or instructional objectives. Well written, competency-based objectives are stated in behavioral terms and specify what the trainee should be able to perform upon successful completion of the training program.⁶ These objectives dictate the training content and provide guidance for the evaluation measures that will indicate program effectiveness.

The SCCPHP training development process is led by an experienced and credentialed instructional designer. Based on the area of priority identified in the needs assessment, a content expert is selected and contacted by the instructional designer. The content expert, who will serve as the instructor, reviews the core competencies with the instructional designer and determines which competencies can be best addressed by the training. Then the content expert and instructional designer write the instructional goals for the training (i.e., a statement that illustrates what the public health professionals enrolled in the training should learn).

Perhaps the most critical aspect of the process is to create learning objectives using chosen core competencies to guide development. The learning objectives provide a roadmap

for the entire training process and guide the training development and evaluation components.^{6,7} Working with the instructional designer, the instructor creates learning objectives that are competency-based and explain what the learner should know or be able to do after completing the training. Because of their importance to the process, the instructional designer then assesses each objective and maps it onto the competencies to ensure the training is competency-based.

At this point in the process, the course description, instructional goals, and learning objectives are forwarded to the SCCPHP practice partners for review. This vetting process by key stakeholders helps ensure that the training is practice based and relevant for the public health workforce in the region. The training material is then revised to include the thoughts and opinions of the practice partners from each of the four states.

After the material is revised, the instructional designer then plans an instructional strategy, working with the instructor to identify the sequence of events and training materials to facilitate learning. This collaborative process includes creating practice exercises and handouts and designing job aids and PowerPoint presentations.

The last step in the design process is to develop an assessment to evaluate each of the learning objectives. Because each element of the training relates directly back to the competency-based learning objectives, an assessment (e.g., test, exercise) is created such that each question addresses an objective. This is important to ensure that the assessment remains focused on the competency-based learning objectives that were identified. The instructional materials are then finalized and the instructional designer notifies the SCCPHP academic program manager that training is ready to be launched.

Phase III: Implementation

Electronic fliers that promote finalized courses are developed by the SCCPHP academic program manager and then distributed to workforce development contacts at the health departments. Upon receiving the promotional materials, each state partner individualizes its method of promoting the course to its workers (e.g., newsletter, regional meeting, etc.). The SCCPHP academic program manager is responsible for enrolling the participants and providing them with access information. After successful completion of a course, the trainee is e-mailed a certificate of successful completion and the state partner is sent notification of successful course completion for that individual.

Training provided by the SCCPHP is delivered via distance learning formats, with the primary delivery method the asynchronous web modality described below. Distance learning provides a platform for trainees from multiple sites to access and interact with an instructor from a distant location. Distance learning affords greater flexibility for the public health workforce (i.e., trainees can access this training at any time during their regular work day or in the evening and do not need to travel to reach the training site) and is recognized as an important component of current workforce development initiatives.^{29–32} Further, the web-based training provided by the SCCPHP is self-directed learning. To provide guidance and support for web-based training, the SCCPHP offers students a training module entitled,

“Learning to be a Distant Learner.” Research has demonstrated that the effectiveness of web-based instruction is enhanced through this type of introduction to the platform as well as the ongoing support provided by the SCCPHP technical support team.^{33–35}

The SCCPHP’s web-based training is presented using the Tegrity Web Learner platform.³⁶ Instructors may use any teaching materials they wish and may interact with their material in exactly the same fashion as in the classroom setting. For example, the instructor can write on a whiteboard and Tegrity will capture what is written and will incorporate the new material into the streaming presentation as a PowerPoint slide. Students can see what the instructor is writing on the whiteboard exactly as they can in the classroom. This requires no prior slide development by the instructor. Tegrity automatically captures all materials and annotations or other interactions used, and then automates the creation of the streaming files with full audio, video, and synchronized slides. Tegrity also indexes the material and produces easily printable files of all instructional slides. Following an instructor’s presentation, the streaming version of the presentation can be available on an SCCPHP website within one hour. Tegrity has broad-reaching capacity in the event of an emergency; automation of streaming media files essentially creates training surge capacity for use during an outbreak event. New information for the public health workforce can be made available within hours through web-based methods using a wide array of sophisticated training aids.

Phase IV: Evaluation

Training evaluation can be defined as the systematic collection of descriptive and judgmental information necessary to make effective training decisions.⁶ One of the objectives of the SCCPHP is to work with state and local health agencies to develop common methods for evaluating the effectiveness of the training activities to increase specific competencies and the capacity to respond to bioterrorism, infectious disease, and other public health threats and emergency events. Accountability for SCCPHP activities is a high priority and is assured through frequent monitoring and evaluation of the SCCPHP in providing competency-based activities and meeting the education and training needs identified by the state and local health agencies.

Evaluation criteria. Training provided by the SCCPHP is systematically evaluated according to a four-level framework that examines training outcomes by measuring:^{37,38}

- Reactions to the training program (Level 1);
- Learning during training (Level 2);
- Behavior following training (Level 3); and
- Results of the training program in meeting organizational goals (Level 4).

While most training program evaluations utilize only Level 1 criteria,^{4,39,40} the SCCPHP uses both Level 1 and 2 criteria and is also currently developing Level 3 measures to assess training program effectiveness.⁴¹

Level 1 measures are designed to assess reactions to the training program, including individuals’ thoughts and feel-

ings about the perceived effectiveness of the instructor, training content, format, and delivery method. The Teaching and Learning Environment Questionnaire—Distant Learning Form (TLEQ-D) was developed to collect this information.⁴² In accordance with recommended guidelines for survey development, the questionnaire was validated by standardized procedures to ensure that responses reflect appropriate opinions of the public health workforce (e.g., reviewed by representatives of the health departments for clarity and completeness). The TLEQ-D measures learner satisfaction with various facets of the training. This information is considered a critical factor in the public health professional’s continued use of SCCPHP training.^{6,39} The TLEQ-D also measures perceived relevance of the training, which serves as useful indicators of training-related knowledge acquisition and on-the-job performance.^{2,39,43} Therefore, results of the TLEQ-D provide evidence of the impact of training on learner attitudes and perceptions.

Level 2 measures are designed to determine the extent to which learners acquired the principles, facts, techniques, and attitudes stated in the competency-based learning objectives. The SCCPHP instructional designer works closely with individual instructors to develop on-line written tests, including true/false and multiple choice examinations, exercises, and case studies to measure training-related knowledge and skill acquisition. The on-line exercises and tests also include debriefing materials that explain the answers to the learners. These indepth explanations are directly linked to the competency-based learning objectives. Results of the on-line testing and exercises provide evidence of the impact of training on learner knowledge and skill.

Level 3 measures are designed to assess the extent to which the acquired learning transfers to improved job performance. To assess on-the-job behavioral changes, the SCCPHP is developing surveys based on professional guidelines^{44,45} and established SCCPHP learning objectives. The surveys will follow a content-oriented validation strategy utilizing personnel from the health departments as subject-matter experts and will be closely linked to the competency-based learning objectives. The measures will be designed as a multi-source evaluation akin to a 360-degree feedback system (i.e., information will be gathered from supervisors, peers, and self-assessments). The surveys will gather both qualitative and quantitative data to provide evidence of the impact of training on job performance.

Level 4 evaluations are designed to assess how the training program contributes to the objectives of the organization. Outcomes include cost reductions as well as increases in service, quality, or workforce retention. This type of evaluation provides information on the impact of training on the organization’s bottom line. Information obtained from Level 4 evaluations may be used to address issues such as the utility of a web-based training program over a traditional classroom training program and the utility of the training program in enhancing the preparedness of the public health workforce. Utility analysis is a general methodology that can be used to obtain information on the relative effectiveness of the training.^{46,47} Once results are obtained from the SCCPHP performance-based (Level 3) evaluations, utility analysis models can be used to assess the relative efficiency

of emergency preparedness training programs^{48,49} and address research issues related to return on investment in public health workforce development.^{2,5,50}

An important contribution of the framework is that the information obtained from the four levels of evaluation may be integrated to provide an accurate and thorough evaluation of the training system itself.⁴¹ For example, for a given training course, results from Level 1 (reactions) and Level 2 (learning) evaluations can be combined with those from Level 3 (on-the-job behaviors) to gain a more comprehensive understanding of training outcomes. In this way, information can be synthesized to determine the extent to which the trainees perceived the training as useful, learned the relevant information, transferred this learning to improved performance on the job, and, ultimately, whether the training led to increased capacity of the public health workforce.

Evaluation research design. The evaluation process also includes using the appropriate research design to assess the effectiveness of the training program in meeting its training goals. Quasi-experimental evaluation designs are used to address the questions of: (1) did the trainees find the training satisfactory and relevant for their jobs? If not, why not?; (2) did the trainees acquire the competency-related abilities and skills specified by the learning objectives? If not, why not?; (3) did the learned abilities and skills transfer to the work setting? If not, why not?; and, ultimately, (4) did the training lead to increased capacity of the public health workforce in responding to emergency events? If not, why not? Appropriate research designs will not only help answer these questions, but will also provide information on how to further improve the training.⁵¹

Answers to these questions help to identify issues such as flawed learning objectives, training content that is not job-relevant, faulty instructional methods, or organizational factors that do not support training. For example, one important question for research and practice in emergency preparedness training focuses on the effect of the organization itself on employee capacity to perform training-related behaviors.^{2,18,52,53} In other words, even if an individual is adequately trained, to what extent will organizational factors such as staffing shortages or lack of adequate supplies and equipment impact training-related performance? The SCCPHP training system has been designed to address this critical evaluation question.

Information resulting from the SCCPHP evaluation designs are used to modify features of the training system and ensure continuous improvement. For example, taken together, the results from the various levels of evaluation may indicate specific areas for improvement in any given course. This information can be fed back into the system to assist in the modification of course features such as learning objectives, content, and delivery methods. On the other hand, results may demonstrate significant improvement in training-related learning and performance, indicating the workforce is more prepared to respond to public health threats and emergencies in those training-related areas. These results would be fed back into the system and suggest that a reassessment of training needs is necessary.

Development of the SCCPHP training program is an iterative and continually evolving process. As demonstrated

by the feedback loops in the model (Figure), the SCCPHP continuously strives to improve the system and enhance the preparedness of the public health workforce in the face of ongoing and ever-changing challenges to public health.

CONCLUSION

The SCCPHP provides training to prepare public health workers to plan for and rapidly respond to public health threats and emergencies. The SCCPHP Training System Model allows for a systematic approach to assessing, designing, developing, implementing, and evaluating training that is both competency-driven and practice-based. Further, the model ensures a standardized process is used across public health occupations and geographic regions, while allowing for tailoring of the content to meet the specific training needs of the workforce in the respective state and local health departments. In sum, the SCCPHP Training System Model provides evidence of the reciprocal nature between research and practice needed to advance the area of emergency preparedness training and workforce development initiatives in public health.^{4,54}

This research was supported by the ASPH/CDC Project No. A1001-21/22.

REFERENCES

1. South Central Center for Public Health Preparedness. Tulane University School of Public Health and Tropical Medicine [cited 2004 Apr 14]. Available from: URL: <http://scphp.sph.tulane.edu/scphp/>.
2. Cioffi JP, Lichtveld MY, Tilson H. A research agenda for public health workforce development. *J Public Health Manag Pract* 2004;10:186-92.
3. Potter MA, Barron G, Cioffi JP. A model for public health workforce development using national public health performance standards. *J Public Health Manag Pract* 2003;9:199-207.
4. Potter MA, Ley CE, Fertman CI, Eggleston MM, Duman S. Evaluating workforce development: perspectives, processes, and lessons learned. *J Public Health Manag Pract* 2003;9:489-95.
5. Tilson H, Gebbie K. The public health workforce. *Annu Rev Public Health* 2004; 25:341-56.
6. Goldstein IL, Ford JK. Training in organizations: Needs assessment, development, and evaluation. 4th ed. Pacific Grove (CA): Brooks-Cole; 2002.
7. Goldstein IL, Gilliam P. Training system issues in the year 2000. *Am Psychol* 1990;45:134-43.
8. Columbia University School of Nursing, Center for Health Policy. Bioterrorism & emergency preparedness: competencies for all public health workers [cited 2004 Apr 14]. Available from: URL: <http://cpmcnet.columbia.edu/dept/nursing/institutes-centers/chphsr/btcomps.pdf>
9. Gebbie K, Merrill J. Public health worker competencies for emergency response. *J Public Health Manag Pract* 2002;8:73-81.
10. Salas E, Cannon-Bowers JA. The science of training: a decade of progress. *Annu Rev Psychol* 2001;52:471-99.
11. Dato VM, Potter MA, Fertman CI. Training readiness of public health agencies: a framework for assessment. *J Public Health Manag Pract* 2001;7:91-5.
12. Campbell JP, Kuncel NR. Individual and team training. In: Anderson N, Ones DS, Sinangil HK, Viswesvaran C, editors. *Handbook of industrial, work, and organizational psychology*. Volume I: Personnel psychology. Thousand Oaks (CA): Sage Publications; 2002. p. 278-312.
13. Potter MA, Pistella CL, Fertman CI, Dato VM. Needs assessment and a model agenda for training the public health workforce. *Am J Public Health* 2000;90:1294-6.
14. Kraiger K. Perspectives on training and development. In: Borman

- WC, Ilgen DR, Klimoski RJ, editors. *Handbook of psychology: industrial and organizational psychology*. Vol 12. Hoboken (NJ): John Wiley & Sons; 2003. p. 171-92.
15. Kennedy VC, Moore FI. A systems approach to public health workforce development. *J Public Health Manag Pract* 2001;7:17-22.
16. Baldwin TT, Ford JK. Transfer of training: a review and directions for future research. *Pers Psychol* 1988;41:63-105.
17. Burke MJ, Sarpy SA. Improving worker safety and health through interventions. In: Hofmann DA, Tetrick LE, editors. *Health and safety in organizations: a multilevel perspective*. San Francisco: Jossey-Bass; 2003. p. 56-90.
18. Potter MA, Barron G, Cioffi JP. A model for public health workforce development using the national public health performance standards. *J Public Health Manag Pract* 2003;9:199-207.
19. Peters LH, O'Connor EJ. Situational constraints and work outcomes: the influence of a frequently overlooked construct. *Academy Mgt Rev* 1980;5:391-7.
20. Kozlowski SW, Brown KG, Weissbein DA, Canon-Bowers JA, Salas E. A multilevel approach to training effectiveness: enhancing horizontal and vertical transfer. In: Klein KJ, Kozlowski SW, editors. *Multilevel theory, research, and methods in organizations: foundations, extensions and new directions*. San Francisco: Jossey Bass; 2000. p. 157-210.
21. Guzzo RA, Gannett BA. The nature of facilitators and inhibitors of effective task performance. In: Schoorman DF, Schneider B, editors. *Facilitating work effectiveness*. Lexington (MA): Lexington Books; 1988. p. 21-43.
22. Peters LH, O'Connor EJ, Eulberg JR. Situational constraints: sources, consequences, and future considerations. *R Pers Hum Res Mgt* 1985;3:79-114.
23. Mathieu JD, Tannenbaum SI, Salas E. Influences of individual and situational characteristics on measures of training effectiveness. *Aca Mgt J* 1997;35:828-47.
24. Noe RA, Colquitt JA. Planning for training impact: principles of training effectiveness. In: Kraiger K, editor. *Creating, implementing, and maintaining effective training and development: state-of-the-art lessons for practice*. San Francisco: Jossey-Bass; 2002. p. 53-79.
25. Chauvin SW, Sarpy SA. *The Training Needs Assessment Workshop (TNAW)*. New Orleans: Tulane University Medical Center and the South Central Center for Public Health Preparedness, Tulane University School of Public Health and Tropical Medicine; 2003.
26. Chauvin SW, Sarpy SA, Anderson AC. *The Training Needs Assessment Questionnaire (TNAQ)*. New Orleans: Tulane University Medical Center and the South Central Center for Public Health Preparedness, Tulane University School of Public Health and Tropical Medicine; 2003.
27. Chauvin SW, Bowditch BE, Anderson AC. Assessing the professional development needs of public health professionals. *J Public Health Manag Pract* 2001;7:23-37.
28. Hites L. New Orleans Department of Public Health emergency preparedness needs assessment. New Orleans: Tulane University Medical Center and the South Central Center for Public Health Preparedness, Tulane University School of Public Health and Tropical Medicine; 2004.
29. Department of Health and Human Services (US), Public Health Service, Office of Disease Prevention and Health Promotion. *The public health workforce: an agenda for the 21st century*. Washington: Government Printing Office, 1997.
30. Ellery J. Training the public health education workforce. *Am J Public Health* 2002;92:1053.
31. Gebbie KM, Hwang I. Preparing currently employed public health nurses for changes in the health system. *Am J Public Health* 2000;90:716-21.
32. Tilson H, Gebbie KM. Public health physicians: an endangered species. *Am J Prev Med* 2001;21:223-40.
33. Brown KG. Using computers to deliver training: which employees learn and why. *Pers Psychol* 2001;54:271-96.
34. Brown KG, Ford JK. Using computer technology in training: Building an infrastructure for active learning. In: Kraiger K, editor. *Creating, implementing, and maintaining effective training and development: State-of-the-art lessons for practice*. San Francisco: Jossey-Bass; 2002. p. 192-233.
35. Threlkeld R, Rozoska K. Research in distance education. In: Willis B, editor. *Distance education: strategies and tools*. Englewood Cliffs (NJ): Educational Technology Publications; 1994.
36. Tegrity Web Learner. Santa Clara (CA): Tegrity, Inc. Tegrity Version 6.1; 2004. Also available from: URL: <http://www.tegrity.com/about.php>
37. Kirkpatrick DL. Techniques for evaluating training programs. *J Am Soc Train Dir* 1959;13:3-9, 21-6.
38. Kirkpatrick DL. Program design and development: evaluation. In: Craig RL, editor. *The ASTD training and development handbook*. 4th ed. New York: McGraw-Hill; 1996. p. 294-312.
39. Alliger GM, Tannenbaum SI, Bennett W Jr, Traver J, Shotland A. A meta-analysis of the relations among training criteria. *Pers Psychol* 1997;50:341-58.
40. Van Buren ME, Erskine W. *The 2002 ASTD state of the industry report*. Alexandria (VA): American Society of Training and Development; 2002.
41. Sarpy SA, Chauvin SW, Anderson AC. Evaluation of the effectiveness of the South Central Center for Public Health Preparedness training. *Pub Health Rep* 2003;118:568-72.
42. Chauvin SW, Sarpy SA. *The Teaching and Learning Environmental Questionnaire—Distance Learning Form (TLEQD)*. New Orleans: Tulane University Medical Center and the South Central Center for Public Health Preparedness, Tulane University School of Public Health and Tropical Medicine; 2003.
43. Alliger GM, Janak EA. Kirkpatrick's level of training criteria: thirty years later. *Pers Psychol* 1989;42:331-42.
44. Uniform guidelines on employee selection procedures. *Federal Register* 1978;43:38290-315.
45. Burke MJ, Sarpy SA, Tesluk P, Smith-Crowe K. General safety performance: a test of a grounded theoretical model. *Pers Psychol* 2002;55:429-57.
46. Kraiger K. Decision-based evaluation. In: Kraiger K, editor. *Creating, implementing, and maintaining effective training and development: state-of-the-art lessons for practice*. San Francisco: Jossey-Bass; 2002. p. 331-75.
47. Cascio WF. Using utility analysis to assess training outcomes. In: Goldstein I, editor. *Training and development in organizations*. San Francisco: Jossey-Bass; 1989. p. 63-88.
48. Raju NS, Burke MJ, Normand J. A new approach for utility analysis. *J Appl Psychol* 1990;75:3-12.
49. Cascio WF. *Costing human resources: the financial impact of behavior in organizations*. Boston: PWS-Kent; 1991.
50. Institute of Medicine. *The future of the public's health in the 21st century*. Washington: National Academies Press; 2002.
51. Sackett PR, Mullen EJ. Beyond formal experimental design: towards an expanded view of the training evaluation process. *Pers Psychol* 1993;46:613-27.
52. Council on Linkages Between Academia and Public Health Practice. *National public health systems research leadership forum*. Last revised 2004 March 9 [cited 2004 Apr 14]. Available from: URL: http://www.phf.org/Link/Forum_Summary&Responses.pdf
53. Trust for America's Health. *Ready or not? Protecting the public's health in the age of bioterrorism* [cited 2004 Apr 14]. Available from: URL: <http://healthyamericans.org/reports/bioterror04/>
54. Lichtveld MY, Cioffi JP, Baker EL, Bailey SB, Gebbie K, Henderson JV, et al. Partnership for front-line success: a call for a national agenda on workforce development. *J Public Health Manag Pract* 2001;7:1-7.