

**SCCPHP Level 4 Evaluations: The Relationship between Emergency Preparedness
and Response Training and Related Outcomes**

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Introduction

The South Central Center for Public Health Preparedness (SCCPHP) is an academic/practice 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 mission of the SCCPHP is to prepare the workforce to respond to public health threats and emergencies including biological, chemical, nuclear, radiological, terrorism, and 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 threats and emergency events.

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.

The purpose of this report is to discuss emergency preparedness and response issues concerning assessments of the relationship between emergency preparedness and response training and related outcomes (e.g., rate at which vaccine clinics process patients; percent proportion of at-risk population that was successfully provided prophylaxis). The information presented in this report will provide the Centers for Disease Control and Prevention, the Association of Schools of Public Health, and other

Academic Centers for Public Health Preparedness with a framework and background materials for designing training evaluation studies to address the following question: Does Emergency Preparedness and Response Training Translate into Desired Outcomes?

First, a discussion of a training system model utilized by the SCCPHP is presented to demonstrate how emergency preparedness and response training evaluation studies fit into the context of a broader training system. Second, issues concerning the design of several types of training evaluation studies for assessing relationships between emergency preparedness and response training and related outcomes will be discussed. Third, the role of the organizational and work context in emergency preparedness and response training evaluation efforts will be discussed. Together, information presented in these sections will provide a framework for assessing the costs and benefits associated with emergency preparedness and response training. This framework has been successfully implemented in other related disciplines; that is, the evaluation of occupational health and safety training for nuclear workers (Burke, Teluk, & Sarpy, 1998).

The South Central Center for Public Health Preparedness Training System Model

Training provided by the SCCPHP is systematically evaluated according to a four level framework that examines training outcomes with respect to various aspects of the learner (Kirkpatrick, 1959; 1996). These training criteria include measures of 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); (Sarpy, Chauvin, & Anderson, 2002). While most training program

evaluations utilize only Level 1 criteria (Alliger, Tannenbaum, Bennett, Traver, & Shotland, 1997; Van Burren & Erskine, 2002), the SCCPHP uses Levels. 1, 2, and 3 criteria to assess training program effectiveness.

Level 1 measures are designed to assess reactions to the training program and include individual's thoughts and feelings about the perceived effectiveness of the instructor, training content, format, and delivery method. To measure reactions to training provided by the SCCPHP, the Tulane Learning Environment Questionnaire – Distant Learning Form (TLEQ-D) was developed (Chauvin & Sarpy, 2003). The TLEQ-D measures learner satisfaction with various facets of the training. This information is often a critical factor in the public health professional's continued use of SCCPHP training (Alliger, Tannenbaum, Bennett, Traver, & Shotland, 1997; Gollstein & Ford, 2002). The TLEQ-D also measures perceived relevance of the training, which serves as a useful indicator of training-related knowledge acquisition and on-the-job performance (Alliger & Janak, 1989; Alliger, Tannenbaum, Bennett, Traver, & Shotland, 1997). 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 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 transfer to improved job performance. To assess on-the job behavioral changes, the SCCPHP developed surveys (Sarpy, 2005) based on professional guidelines (Uniform Guidelines, 2002; Burke, Sarpy, Tesluk & Smith-Crowe, 2002) and the emergency preparedness and response competencies (Columbia University, School of Nursing, 2002). The Level 3 measures focus upon the extent to which trainees report capacity to perform the emergency preparedness and response training-related activities. These measures have also been utilized in measuring public health workers' performance 3 to 6 months following training (Sarpy, 2006a) as well as their performance during exercises and drills (Sarpy, Warren, Bradley, Kaplan, & Howe, 2005) to provide evidence of the impact of training on learner behavior..

Level 4 evaluations are designed to assess the utility of the training program in terms of its contribution to the objectives of the organization. Results of training can include outcomes such as cost reductions as well as increases in service, quality, or workforce retention. This type of evaluation provides information concerning the impact of training on the organization's bottom line. An assessment of the extent to which emergency response and preparedness training is associated with valued organizational outcomes such as increases in individuals appropriately quarantined or isolated or decreased response rate. It cannot be assumed that simply because trainees react positively to SCCPHP training methods, acquire the intended knowledge, skills, and abilities (KSAs) associated with the emergency preparedness and response competencies from training, and demonstrate these emergency preparedness and response-related KSAs during exercises and drills, that desired outcomes (e.g., percent of persons under isolation

who are quarantined that receive a daily compliance contract; time to assign a case manager to person under isolation and quarantine) will be obtained given an actual emergency event. In fact, it has been demonstrated that trainee reactions, learning, and behaviors, and training results are often not as closely related to each other as is often assumed (Alliger & Janak, 1989; Alliger, Tanenbaum, Bennet, Traver, & Shotland, 1997; Goldstein & Ford, 2002). For instance, if training causes change in behaviors that are not relevant to emergency preparedness and response events, training will not lead to its intended outcomes. On the other hand, work obstacles (e.g., lack of needed equipment and supplies) or other factors in the work setting (e.g., poor communication and coordination) may inhibit the demonstration of appropriate emergency preparedness and response-related behaviors. Given the possibility that training will not directly lead to organizationally-valued outcomes, then it is important that the evaluation process address the intended results of emergency preparedness and response training efforts. In addition, although different methods of emergency preparedness and response training may result in positive outcomes (e.g., greater frequency of updates to tracking system; decreased percentage of persons caring for isolated patients who acquire the same infection during the isolation period), these outcomes may be attained with different costs and degrees of effectiveness. Without an understanding of the relative costs and benefits of different emergency preparedness and response training programs, training expenditures may not be used in the most effective and efficient manner. Therefore, further examination of these issues for emergency preparedness and response training is warranted.

Conducting SCCPHP Level 4 Training Evaluation Efforts

Whereas a Level 3 training evaluation effort focuses on the extent to which training leads to improved emergency preparedness and response performance, a Level 4 evaluation examines the extent to which training is associated with outcomes that are expected from the demonstration of these behaviors. In the context of emergency preparedness and response training provided by the SCCPHP and other Academic Centers for Public Health Preparedness (A-CPHPs), the outcomes are enumerated in the Target Capabilities List (TCL) version 2.0 (Department of Homeland Security, 2005).

A number of questions could be posed for assessing the relationship between emergency preparedness and response training and these desired outcomes. For example, what is the relative effectiveness (benefit) or relative efficiency (cost/benefit) of alternative methods (e.g., distance learning versus face-to-face; lecture-based versus hands-on) of emergency preparedness and response training? As discussed in the following sections, the type of question that is posed will necessitate the use of different training evaluation methods and procedures for appropriately addressing the question.

The Relative Effectiveness of Alternative Types and Methods of Emergency Preparedness and Response Training. One question that can be addressed is whether certain training methods are superior to others in terms of more effectively producing desired emergency preparedness and response-related outcomes for the public health workforce. For instance, it may be expected that training delivered by the SCCPHP and other A-CPHP is more effective in terms of attaining these outcomes than training conducted by other agencies. This expectation can be attributed to the input of the

practice partners' perspective in developing the training (i.e., representing the needs of the health department workers) and, therefore, the public health emphasis of the training that results. That is, training provided by the SCCPHP, which imparts greater public health specificity in its content, should result in more effective learning and performance of public health workers than the more general emergency preparedness and response training developed and presented by other organizations (e.g., Federal Emergency Management Agency).

Conducting this type of an evaluation effort would require a comparison of the training-related outcomes (e.g., time to release educational information to public after isolation or quarantine is ordered; time to update database that tracks an isolated or quarantined person's details) for public health workers trained in a particular content area (e.g., Isolation and Quarantine) at the SCCPHP compared to public health workers trained by other organizations (e.g., Federal Emergency Management Agency).

Along a similar vein, various methods of emergency and response training could be examined to evaluate whether certain methods of training (e.g., lecture-based versus hands-on; on-line versus face-to-face) are more effective than others in producing valued outcomes. Recent research in occupational health and safety has demonstrated that more engaging, hands-on training methods are associated with greater knowledge acquisition and training-related outcomes than more passive, lecture-based methods (Burke, Sarpy, Smith-Crowe, Chan, Islam, & Salvador, 2006). Similarly, more engaging methods of emergency preparedness and response training may result in greater learning and desired outcomes than more passive methods. Therefore, a comparison of the training-related

outcomes of public health workers trained in a particular content area by different training methods also could be made.

It is important that the forms of training being compared are as similar as possible to each other in terms of general content and length so that the primary difference between the two groups of trainees is in the type or method by which they were trained. As suggested by researchers in related fields (Burke, Tesluk, & Sarpy, 1998), when studying whether or not any differences in these outcomes may be due to the types or methods of training, one is cautioned against statistically controlling for differences in demographic factors (e.g., level of experience, training history) between members of the training groups or the use of matched-pairs designs (designs that pair trainees who are similar) for evaluating training. A critical assumption for employing these latter types of statistical analyses is that the trainees have been randomly assigned to the training methods. A number of researchers have pointed out that the use of such techniques for the purposes of “equating” nonequivalent groups is by and large invalid and will nearly always produce biased estimates of the effectiveness of different interventions in field settings (Lord, 1967; Reichardt, 1979).

Relationships between Training Histories and Outcomes. Another important, but different, set of questions that can be asked about the effect of emergency preparedness training concern whether more extensive training (e.g., in the form of attending additional training courses/programs or hours spent in training) results in increased training-related outcomes. Information gathered from workers’ training records, such as those found in the Learning Management Systems used by state and local health departments, can be used to measure emergency preparedness and response

training *depth* (i.e., the amount of training a worker has received in a particular area), *breadth* (i.e., the range of different areas in which a worker has been trained), and *recency* (i.e., when a worker received their most recent training). Relating the depth, breadth, and recency of training to training-related outcomes might provide information on whether more extensive training in a particular area is more beneficial than receiving emergency preparedness training in several different areas.

For example, with respect to health and safety performance, recent research has found that depth of knowledge is associated with increased performance on more routine health and safety tasks in which they consistently engage (e.g., engaging in work practices to reduce risk). (Burke, Sarpy, Tesluk, Smith-Crowe, 2002). On the other hand, breadth of knowledge is associated with increased performance on tasks associated with unforeseen critical incidents that are inconsistent in nature and non-routine events (e.g., communicating information related to emergencies, accidents, and exposures). Based on these findings, the effects associated with the depth, breadth, and recency of emergency preparedness and response training very well may depend on the type of work and the types of emergencies to which different workers will potentially respond. For instance, in cases where workers will potentially respond to a number of very different threats and emergencies, having greater breadth in terms of being trained in different emergency preparedness and response areas may be more effective at increasing related outcomes than being trained more extensively in a limited range of areas. Research of this nature would directly address the relative effectiveness of the “all hazards” approach to emergency preparedness and response training for public health workers (Potter, Eggleston, Geittig, & Sain, 2004).

The Relative Efficiency (Cost/Benefit) of Alternative Methods of Emergency

Preparedness and Response Training. With the proliferation of emergency preparedness and response training offered, an important question becomes, what type of training most efficiently produces its desired results. Thus, one can apply the methodology of utility analysis to address the questions of what is the relative cost-benefit of different types or methods of training. Utility analysis is a general methodology for expressing the outcomes of human resource programs such as training in terms of a standard metric (e.g., dollars); (Cascio, 1989). Although the results of utility analysis are most often expressed in terms of dollars or percent improvement in performance, other metrics may be used.

In a sense, utility analysis provides a comparison of the costs involved in providing training to the benefits of training. Utility analysis provides information about the costs of a training program and allows comparisons between types or methods of training (Goldstein & Ford, 2002). Costs can be calculated in terms of the fixed costs of designing and delivering a training program (e.g., costs of converting and maintaining distant delivery courses) as well as the costs involved in training successive cohorts of trainees (e.g., time spent in training rather than on-the-job); (Cascio, 1991). Calculation of training benefits can include outcomes such as the rate at which dispensing centers process patients, or the rate of administration of an intervention was affected by the supply chain or other logistical problems, and the associated dollar costs (reductions). More precise determinations of training costs and benefits can be gathered by including effects due to public health worker attrition and possible decay in the strength of training effects over time (Sarpy, Warren, Kaplan, Bradley, & Christian, 2006).

A number of different utility analysis models that employ these basic concepts are available and can be used to assess the relative efficiency of emergency preparedness and response training programs. For example, Mathieu and Leonard (1987) examined the effectiveness of a particular method of training (i.e., behavioral role modeling) using utility analysis. Further, the Raju, Burke, and Normand (1990) utility model, a method of estimating training program utility, was applied to evaluating the relationships between training and related outcomes in a related discipline (i.e., safety training and safety-related outcomes). For more detailed discussions of utility analysis, the reader is referred to Cascio (1989; 1991).

Because the results of utility analysis are expressed in a common metric, a valuable application of the information gained from a training utility analysis is a comparison of the relative effectiveness and efficiency of alternative types and methods of emergency preparedness and response training. For instance, although different methods of training may result in similar outcomes, one method of emergency preparedness and response training may be considerably more cost effective than another. Results from utility analyses can therefore be used to guide decisions about where more effectively to allocate emergency preparedness and response resources.

The Effect of Organizational and Work Context on Emergency Preparedness and Response Training Evaluation Efforts. In understanding the effects of workforce development initiatives on building emergency preparedness and response capacity of public health workers, it is crucial to consider organizational factors that can either positively or negatively influence the effects of training. These organizational factors are the conditions in the work environment that can either facilitate or inhibit the attainment

of high levels of effectiveness (i.e., enhanced preparedness and response of the public health workforce). One should consider these factors in examining workforce training initiatives and, in particular, their effect on workers' transferring the training learned during the course into improved performance on emergency preparedness and response tasks and related outcomes (Burke & Sarpy, 2003; Ford, Quinones, Sego & Sora, 1992). For example, one often asked and very important question for research and practice in emergency preparedness and response focuses on the effect of the organization itself on the capacity to perform these training-related behaviors (Potter, Barron & Cioffi, 2003; Tilson & Gebbie, 2004; Trust for America's Health, 2003).

In general, organizational factors can be classified as either organizational facilitators or organizational barriers (Guzzo & Gannet, 1990). Organizational facilitators represent aspects of the work environment that create an ideal working situation; they help to support the training environment and positively influence training-related knowledge, behaviors, and outcomes. Conversely, organizational barriers are characteristics of the workplace that inhibit or interfere with the performance; in other words, these are the conditions that restrict or prohibit the attainment of training-related performance standards. Thus, organizational facilitators help to ensure that the learning that occurred during training is transferred into improved on-the-job performance, whereas organizational barriers pose constraints and are detrimental to training outcomes (Mathieu, Tannenbaum, & Salas, 1997; Peters & O'Connors, 1980; Peters, O'Connors, & Eulberg, 1985).

Recently, the SCCPHP conducted an organizational analysis to determine the system-wide, organizational components that influence the SCCPHP training

effectiveness in enhancing the preparedness and response of the participating practice partners (Sarpy, Bradley, Christian, Kaplan, & Warren, 2006). To identify these organizational factors, surveys were administered to state and local public health workers and emergency responders to assess organizational factors that either inhibit (i.e., barriers) or support (i.e., facilitators) the competency-related training. The study revealed thirteen categories of organizational factors (e.g., required service and assistance from others; time availability; budgetary support). In general, more organizational facilitators were identified than organizational barriers. However, quantitative analyses demonstrated that the organizational barriers had a greater influence on their workplace performance than did the organizational facilitators. Slight variations in the categories of facilitators and barriers and their perceived level of influence were demonstrated across occupational groupings as well as across state and local level.

The organizational features identified by the SCCPHP have been integrated into a survey instrument that can be used to systematically assess workers' perceptions of the public health department's work environments (Sarpy, 2006b). These types of organizational surveys are particularly important for targeting aspects of the work environment that need improvement. In addition, the information gathered from a thorough assessment of worker perceptions of the work environment, such as those created by the SCCPHP, can be used as a baseline against which to measure future improvements in promoting emergency response and preparedness.

Identification of these factors can help to address the overarching goal of increasing performance of the emergency preparedness and response competencies and address how current levels of effectiveness in emergency preparedness and response can

be improved. Identifying and addressing these factors in the work environment supports workforce training interventions and increases the likelihood that the workers will perform up to standards (in the case of eliminating barriers) and progress to optimal levels of effectiveness (in the case of increasing facilitators). In effect, conditions in the immediate and broader work environment place an upper limit on the potential impact that emergency preparedness and training may have on related outcomes. Understanding the impact of these work and organizational context factors on emergency preparedness and response related outcomes is important for making decisions concerning how best to focus attention and resources to better build capacity of the public health workforce.

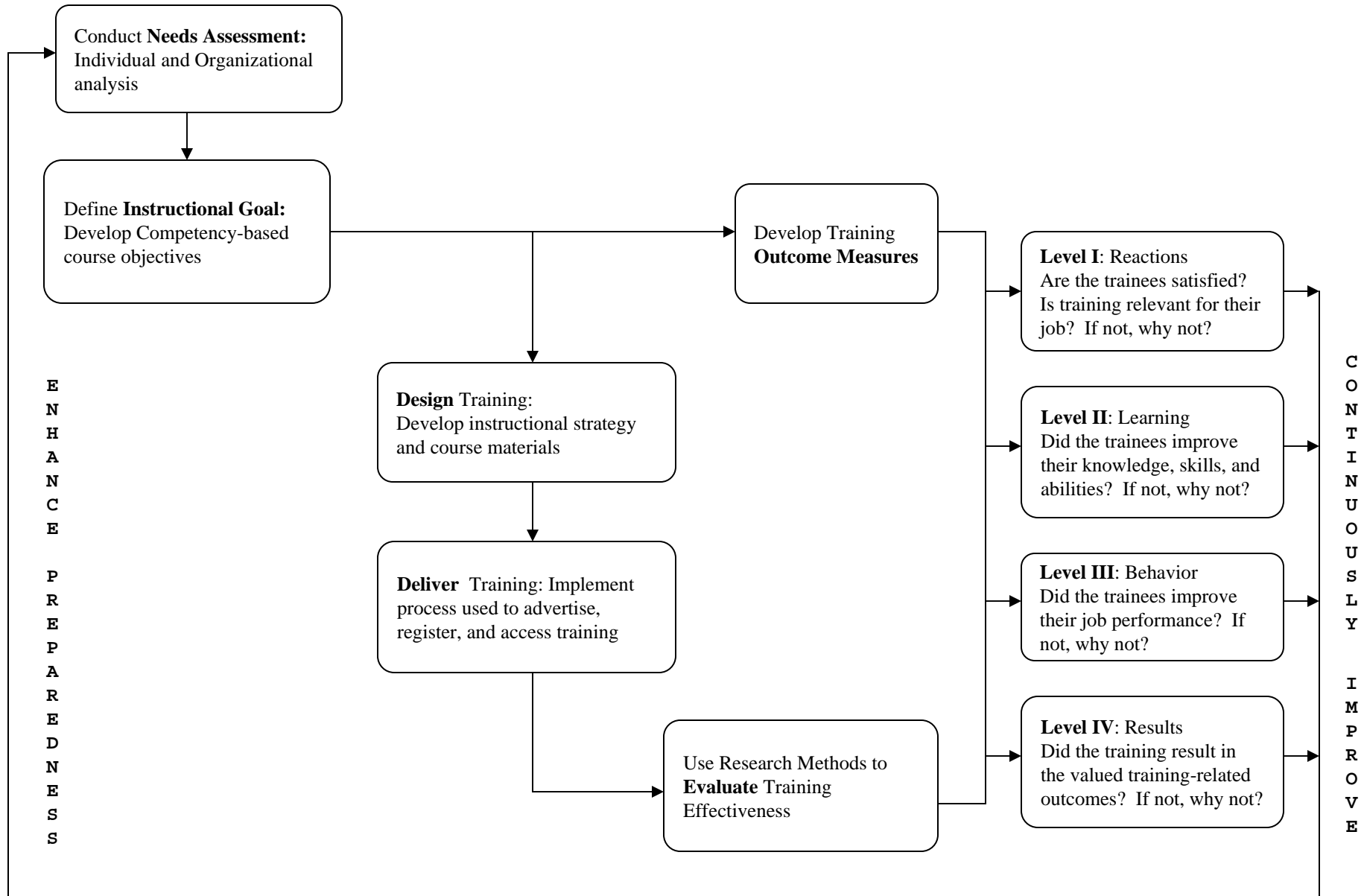
Conclusion

The SCCPHP training system model, adapted from a generic training system model (Goldstein, 1991), emphasizes the major components of instructional design including assessing, designing, delivering, and evaluating training (see Figure 1). 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. These 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 (Goldstein & Ford, 2002; Sarpy, Chauvin, Hites, Santacaterina, Capper, Cuccia, Anderson, & Peters, 2005)

As Figure 1 depicts, the model is a closed-loop system. Information resulting from the evaluation of the 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

Figure 1

The South Central Center for Public Health Preparedness Training System



to plan for and rapidly respond to public health threats and events). This information, therefore, provides feedback necessary to modify training system features such as reassessing training needs, revising course objectives, or altering the delivery method. That is, the information gathered during the training evaluation should be used to modify the training program as needed (e.g., identification of training needs) to produce the desired outcomes.

The material presented above provides a general framework for assessing relationships between emergency preparedness training and related outcomes. Additionally, procedures for examining these relationships in a cost/benefit sense were highlighted. As shown by the feedback loops in Figure 1, answers to questions concerning the relationship between training and related outcomes and assessments of the cost/benefit of training provide information for enhancing emergency preparedness and response capacity of the public health workforce and the identification of future training needs. It should be noted that an updated needs assessment is particularly important as training methods evolve and as public health workers roles, responsibilities, and procedures in preparing for and responding to threats and emergencies change over time.

The SCCPHP Training System Model demonstrates its commitment to the goal of continuous improvement. That is, the training process described is used by the SCCPHP in its efforts to continuously improve its training system and enhance competency-related performance of the public health workforce in the face of on-going and ever-changing challenges to public health.

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