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An innovative approach to training hospital -based clinicians for bioterrorist attacks.

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AN INNOVATIVE APPROACH TO TRAINING HOSPITAL-BASED CLINICIANS FOR BIOTERRORIST ATTACKS

by

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ABSTRACT OF DISSERTATION
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The recent attacks of September 11, 2001 and the subsequent dissemination event of anthrax in the United States demonstrated the necessity for hospitals to initiate bioterrorism education for clinicians. Events such as the release of sarin gas into the Tokyo subway by the Aum Shinirikyo cult provided some insight into how quickly emergency medical personnel may be overwhelmed by causalities of unconventional weapons. Educational interventions to prepare hospital-based practitioners for such disasters must fit among the demands of patient care, administrative duties, and continuing education within specialties. Additionally, the priority placed on the topic, confusion about reputable resources to consult, and concerns of funding for preparedness training mandate the need for an authoritative, comprehensive, and easily accessible approach. A pilot project supported in part by the Agency for Healthcare Research and Quality was developed to facilitate streamlining of preparedness efforts through the implementation of interactive screensavers as an alternative to traditional educational modalities. This report presents the successful application of this model, which was quantified with pretests and posttests given to users of the system.

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LIST OF ABBREVIATIONS

AHA	American Hospital Association
APIC	Association for Professionals in Infection Control and Epidemiology Inc.
BT	Bioterrorist
CBX	Computer-based examination
CDC	Centers for Disease Control and Prevention
CD-ROM	Compact disk read-only memory
CE	Continuing education
CME	Continuing medical education
CPSC	Clinical problem-solving cases
ED	Emergency department
IC	Infection control
ICP	Infection control practitioner
PC	Personal computer
UAB	University of Alabama at Birmingham

INTRODUCTION

The anthrax attacks of 2001 moved hospital preparedness plans and educational strategies for personnel from speculation into immediate necessity. Events such as the release of sarin gas into the Tokyo subway by the Aum Shinirikyo cult provided some insight into how quickly emergency medical personnel may be overwhelmed by casualties of unconventional weapons. As found in a recent survey of emergency medicine programs, "Opportunities for the widespread teaching of this material have remained limited, and the range of knowledge regarding even general disaster medical care is also variable..."[1] Raising the level of awareness of a potential bioterrorist (BT) attack in medical personnel requires an extensive and comprehensive multidisciplinary educational approach.[2]

Before the attacks of 2001, there was minimal involvement of hospital organizations in BT preparedness programs.[3] There are many factors influencing their slow integration into community BT disaster response systems. Federal funding for preparedness (equipment and education) has customarily been allocated to first-responders leaving hospitals searching for budgetary justifications for events that were (and still are in many geographical locations) considered highly unlikely. For most hospital organizations, examining the budget for any preparedness funds in the face of managed care and prospective payment systems, alarming nursing shortages and increasing patient volume and complexities may not be a consideration for staying in

operation. The events of September 11, 2001, and the subsequent anthrax outbreaks that year led health care organizations to reevaluate their disaster planning priorities.

The prospect of "whether" a BT event will occur[4] has been replaced by crucial analysis of how well prepared we are to handle a recurrence. Pondering "low-probability, high consequence"[5-7] BT events is no longer acceptable, therefore the expansion of training to all potential medical responders, and specifically to hospital workers has been initiated nationwide. Because anyone in the hospital setting can (and should) act on suspicion of a BT event, this expansion of education is crucial in recognition of questionable high-risk syndromes, isolation of the suspected agents and victims (to prevent a potential epidemic), and non traditional treatment for biological agents unfamiliar to many clinicians.

An adequate BT response plan cannot merely concentrate on the accumulation of equipment and reserve supplies in plant facilities. A comprehensive plan must also raise awareness of BT by educating both ancillary employees such as housekeeping and security personnel and, most importantly the clinicians who may provide primary care. In many hospital disaster protocols, hospital-based clinicians are among the first people called to implement a response plan including recognizing an event, conducting appropriate tests, reporting to public health authorities, placing patients, arranging equipment, and coordinating personnel to provide direct care. Although clinicians may be "textbook" familiar with BT agents and the public health consequences, the clinical presentation and management of a BT events would be unprecedented and, therefore, mandate education.

LITERATURE REVIEW

Until the events of October 2001, published educational interventions of this nature were almost non-existent. With the exception of the guidelines for health care facilities (to be discussed) put forth by the Centers for Disease Prevention and Control (CDC), the Association for Professionals in Infection Control and Epidemiology (APIC), the US Army, and individual states, no actual methodologies for delivery of BT education have been publicized. This researcher believes there are two considerations in assessing this gap in available literature. The gap offers fertile ground for research, and represents underprepared or completely unprepared public and private sectors for BT events.

Theoretical foundations and published successes in health studies, education, social science, transportation, and nursing were applied to develop this innovative program. This literature review is the outcome of an examination of 45 articles from medicine, nursing, and allied health, as well as one meta-analysis of the techniques for evaluating web-based learning, published from 1988 to 2002. The 45 articles examined were then further reduced to 35 articles for inclusion in this review. Exclusion for this review was based on several factors. The study was conducted outside a primary or secondary care setting, the work addressed a non patient care, and/or the focus of the study was on a computerized intervention other than educational use of the World Wide Web or a website (eg, electronic billboard or slide show). Two textbooks, two practice

guideline manuals, and one position paper were considered vital in this discussion and are also included in this review.

The body of the following review is divided by the major themes identified in the review of the literature. These themes include the integration of technology and application in medical education, the application of educational principles in web-based instruction, outcome evaluation, implications for educators, and a supplemental section on the utility of focus groups in the development of educational materials.

Integration of Technology and Application in Medical Education

Many professional health care organizations have begun to embrace computer education and to set goals to "bridge the gap between classroom learning and bedside competence though computer-assisted instruction,"[8] but the basis for this shift in instructional strategy is not well documented. Much of the literature describes web-based interventions supported by multiple factors. The best summary available at this time is the meta-analysis offered by Chumley-Jones et al.[9] which provides an examination of web-based learning papers in nursing, dental and medical education. [9] In this analysis, the authors identified 76 articles that were either defined as either evaluative or descriptive. Of the 76, 31 were categorized as evaluative because these reports presented descriptive statistics, used control-group or pretest-posttest self-controlled design, compared media, and used qualitative methods. The remaining 45 articles provided no data or qualitative design characteristics, although Chumley-Jones et al.[9]did state that the primary purpose for the document was to describe educational materials. The 45 articles did contain evaluation plans, however Chumley-Jones et al.[9] stratified their 31 evaluation

literature results into the four domains of knowledge gains, learning efficiency, program cost, and learner's attitudes, which were then sub-categorized by "web-specific and content-specific."

The analysis of 20 studies identified by Chumley-Jones et al.[9] as evaluating knowledge gains revealed that web-based learning did not surpass other educational methods but did result in improved scores in designs because of the use of multiple choice format posttesting. Sound pedagogy was the only factor significant in determining learner satisfaction in the content-specific studies, and the authors[9] state that there is strong evidence that web-based educational programs can improve self-confidence similar to other methodologies.

The effects of web-specific features on learner attitude included communication with faculty and peers, which was inconclusive, and the use of server statistics in assessing web use patterns.[9] Although noting several studies supporting a learner's preference for web-based learning, Chumley-Jones et al.[9] also related that there are mixed reports of whether learners are more stimulated with web-based education than with traditional methods.

Bell et al.[10] conducted a randomized controlled study of 162 residents at 4 different universities comparing web-based tutorials with self-study print materials. The trial was conducted among residents because, much like the participants for our pilot program, residents were more likely to use self-study print materials frequently, and because the sampling in the setting was convenient. Bell et al.[10] hypothesized that the self-study materials would produce greater learning and that web-based instruction would produce greater "knowledge gain, retention, learning efficiency and satisfaction." [10]

Although these authors[10] found that there were no differences in posttest scores (demonstrated knowledge gain), there was increased learning efficiency (less study time), and the residents were more satisfied with the web-based intervention. Bell and his colleagues[10] note that although the program did increase efficiency and satisfaction, "one self-study exposure may be insufficient for long-term knowledge retention" in learners. The findings of these authors support what we considered to be our greatest strength in the innovative approach: the initial arousal of the learner by the screensaver. We hypothesized that the screensaver installation alone would increase repetition; promote further inquiry about the images; increase frequency of access through convenient physical placement; and ultimately, result in the outcome of increased awareness.

Woo and Kimmick[11] in an investigation of teaching graduate-level nursing research, determined that nursing students expressed greater learning stimulation with Internet education. In their study[11] of 97 graduate nursing students enrolled in a nursing research course, it was concluded that, when comparing a web-based course with traditional lecture-style instruction, the computerized version produced higher learning stimulation but no difference in final course grades.[11] The authors[11] proposed that the expectation of computerized learning must be clear in that the decision to employ the use of computers should be based on desired outcome such as knowledge or satisfaction. Woo and Kimmick[11] caution educators that the adoption of technology in instruction does not guarantee learning improvement. It was the hypothesis of our project that greater satisfaction with the interactive website would naturally induce a greater desire for participation and, therefore, increase learning, awareness, and improved retention.

Woo and Kimmick[11] stated that their limitations of their study included crossover of students, which confounded the results of the control group, and the inability to establish the reliability and validity of the instruments as they apply to Internet teaching. This finding was noteworthy because our study participants served as their own controls; however, like Woo and Kimmick,[11] we were also limited to traditional instrumentation and evaluation techniques (posttesting questionnaire based on awareness level and server statistics) that had not been well-established in technological application. Increased knowledge and awareness were the primary goal of our teaching intervention, and we did not evaluate student satisfaction and engagement in the website or screensavers in the actual pilot. These factors should also be an indicators of successful instruction, and development of reliable and valid evaluation tools is a direction for future study.

Satisfaction and engagement can be caused by a number of factors provided by computer use. The self-paced aspect of flexible accessibility and computer learning may also be contributory in the satisfaction of users and, thus, a driving force for increasing applications in education. The combination of web-based documents and CD-ROM (compact disk read-only memory) allows remote access and self-paced learning, which are important facilitators given the time constraints of busy practitioners.[12] Piemme[13] proposed the advent of computerized medical education as a primary educational source for clinicians by stating that "web-based education transforms the formal learning experience into one that eliminates face-to-face contact while maintaining the ability to provide remediation and increase learning efficiency." Piemme[13] noted that the computer could "transform the way competence is assessed" and extend beyond entry-level educational preparation to include licensure, certifications, and continuing education.

Where bedside application is considered, using a computer further decreases the factual memorization required in medical education because computers have the capacity for voluminous information storage and retrieval and are readily accessible by handhelds, compact, personal computers (PCs) and desk units in the health care setting.

To the present writer's knowledge, published cost analyses are not yet available in the literature; however, in a retrospective study evaluating Internet-based oncologic teaching for medical students, Mehta et al.[14] found that the indirect cost of distributing print material for educational purposes was considerably less than the cost for electronic material and concluded that; with institutional commitment, the management of electronic material is more efficient than traditional educational modalities. None of the work reviewed considered indirect or direct costs associated with project development or maintenance.

Use of Case Simulations and Case Scenarios

The ability of physicians to utilize the critical thinking skills necessary to raise suspicion of a BT agent for timely diagnosis and effective treatment is paramount in preventing an outbreak. In the same way that internships provide supervised training for physicians to build decision-making abilities, electronic educational material must facilitate development of complex problem-solving skills. In the late 1960s, the National Board of Medical Examiners started development of the physician testing with computers that is called computer-based examination (CBX),[13] a common practice for demonstrating competence in almost all medical disciplines today. CBX case simulations were the first of their kind to attribute simulated real-time case scenarios for clinical

management of cases.[13] CBX cases allowed clinicians to manage cases as actual patient encounters including all of the aspects of patient care experienced in a real hospital such as the inability to obtain certain testing and the need to consider differential diagnoses as the clock advances. [13] This development was an important and of particular interest not only because CBX assisted in decision-making skills of physicians but particularly because this method highlighted the appropriateness of care principles not mandated through what was to become a prospective-payment system for reimbursements.

Since the late 1980s, CBX has proved to be highly reliable in determining appropriate practice skills from computerized educational evaluation.[13] CBX was truly the forerunner of the computerized testing now utilized by most of the health care professions in aspects of evaluation that range from computer-based certification of nursing licenses at all levels to determination of clinical competencies in specialty areas such as athletic training. This being said, one can only assume that if licensing and credentialing boards consider testing in case simulations a determinant of actual practice (competence), then recall must occur when a similar real case is confronted.

As computers have evolved, so has the presentation of case simulations. With the advancements of software, machine hardware, and fast connection capabilities, computers are now an indispensable component of patient care management in many settings. As Waeekerle et al.[15] pointed out in their summary of the competencies for emergency care providers, case simulations using differential diagnosis and concurrent medical management that occurs at the point of care are likely to improve retention. This is a potentially significant barrier to BT education and a factor that we demonstrated in our pilot project.

In 2000, the American College of Physicians introduced case simulations through web-based distance-learning techniques.[16] Clinical problem-solving cases (CPSCs) presented participating physicians with simulated cases via interactive computer modules complete with laboratory and diagnostic imaging results. A review of the CPSCs in the *Journal of the American Medical Association* found that the combination of multimedia allowed access to images, audio, additional resources, and immediate remediation through clinical experts. CPSC were described as interactive cases that simulated differential diagnosis, treatment, and immediate feedback on appropriateness of care.[16] CPSCs could be accessed both in review form and the continuing medical education (CME) testing mode with paid registration. The use of CPSCs was found to be quite effective in continuing education CE) for primary care practitioners, as well as in initial training.[17] The American College of Physicians does acknowledge that computerized patient simulations are difficult to develop, but these virtual patient encounters offer the most popular and effective choice for physician education[16] when compared with traditional educational methods.

CME

The Medical Library Association recognized the need for web-based education when the membership expressed a desire to delineate their role in evidence-based medicine. The association noted "methods of acquiring continuing education without the inconvenience of leaving the work area and incurring travel expenses are becoming more popular as professionals strive to remain current with their daily duties and professional concerns."[18] Furthermore, the association posited that inventive ways (through

computers) to deliver education can provide "quality, cost-effective alternatives to traditional continuing-education courses."[18]

The association's position on web-based, interactive instruction follows the trend of many professions seeking to maintain competence in an environment of increased job demands and changing needs of the learner. [11] The massive growth and popularity of the Internet and World Wide Web in education have presented new opportunities for offering timely, continuing education to clinicians. Comparisons of traditional educational methods with computer instruction, although sparse in the literature, do demonstrate higher satisfaction ratings with Internet-based instruction[10] thus explaining the appeal for educators to explore the utility of computer instruction.

The primary purpose of CME for physicians is to maintain a level of competence by potentially changing behavior to incorporate advances in research. Much of the current CME literature fails bridge the gap between scientific findings and practice guidelines.[19] This lack may also support the possibility that traditional CME delivery, specifically self-study materials, fails to produce a behavior change in practice. Consistent with adult learning theory, there is a direct correlation between the level and amount of activity in the learning process and the likelihood of changing behavior.[19] Practice changes are not evaluated by much of the literature on web-based medical education, but participation serves as an important indicator in predicting learning and thus relative behavior changes.

Peterson et al.[19] surveyed physicians who used traditional CME and analyzed frequency of access to on-line CME modules through server statistics. The authors[19] concluded that 88% of their participants (defined by registered users who completed 169

modules and who electronically submitted on-line evaluations) would use on-line CME because of the convenience of access at the worksite and the direct link to their clinical practice.[19] "Traditional CME was based on a dogmatic approach in which an instructor defines a curriculum and transmits the information to the student in a didactic manner using textbooks, journals, meetings, symposia, audiotapes, and videotapes."[17] The traditional method was found by Peterson and his colleagues[19] to be less-preferred.[19] The assumption is that preference would therefore increase participation in more innovative delivery techniques such as having on-line CME available within the workplace. The study by Bell et al.[10] (discussed earlier in the text) also confirmed that there is little proof that traditional methods of educational delivery are effective without incorporation of other methodologies. Studies[19,20] have shown that educational interventions in which the physician receives information passively and in a single occurrence are ineffective which we believe further substantiates the increased engagement of the learner through the use of multiple media enhancement of the learning process and recurring exposures.

Computer assisted instruction allows repeated use at the discretion of the user, which constitutes an important aspect for the time-constrained practitioner who would likely seek the convenience of instruction within the worksite. The addition of a screensaver as a prelude to seeking additional information through an educational Internet site further supports the use of repetitious visual cues to enhance learning and retention. Bell et al.[10] and Peterson et al.[19] confirmed that clinicians found information more pertinent if they chose the content and if the content directly related to their practice, was self-paced, provided the needed continuing credit hours for licensure, and was conveniently delivered at the point of care. Bell et al. [10] also noted that one self-study

exposure may be inefficient in producing knowledge retention; therefore, placement of the intervention at the worksite allowed for learners to utilize the site for information when time permits and to return to specific areas at their leisure.

Application of Educational Principles

Using the Internet in education appeals to a variety of learning styles when assessing knowledge gains, receptivity, and practical application. Agius and Bagnall[20] described the development of an Internet educational effort "rooted in educational theory" as a valuable teaching resource. In their research examining the Internet as an educational tool in occupational and environmental health and medicine, these authors[20] found that case simulations (presented earlier) provided the user with a "concrete experience" involving a "virtual" patient for whom clinical management required consideration of multiple data. We recognized both that because this type of experience would be necessary in the development of a BT educational response since management of actual events could only be speculative at that point in time and that practitioners engaging in actual "mock scenarios" had been successful in other areas of patient care. Similar to our program, Agius and Bagnall's[20] web-based program allowed the user to review select material before to engaging in testing modules, or to open more than one browser simultaneously to switch from detailed information on a page or hyperlink to testing modules. This type of individually-directed learning assists the users in assessing their own needs in the learning process, a technique also known as discovery learning.[20] Agius and Bagnall[20] also describe "active experimentation," which occurred as the clinician considered the multiple data in the differential diagnosis. Active

experimentation is significant in the development of critical thinking skills and is helpful to practitioners before actual patient contact, resulting in improved care of patients. This is another crucial factor we considered in preparing practitioners for a potential BT event, especially because the misdiagnosis of a BT agent in an untimely manner could result in an epidemic.

In the study by Agius and Bagnall[20] immediate feedback, whether from pop-up text boxes for remediation, instructor response via email or chat room, or outcome-oriented programs where answers are not immediately revealed but simply present a desirable or undesirable result, also promoted development of critical appraisal required for appropriate treatment. This appraisal required reflection, conceptualization, and recall of information from page to page. Likewise, information was processed by the learner from the website to supplemental information on the Internet from hyperlinks (when selected by the user), precisely as the screensavers and website information did for the testing modules of our program.

The use of images (eg. photos and graphs) is an important component of web-based instruction. Purdy and Luepnitz[21] studied the effect of imagery on long and short-term retention in 64 subjects.[21] The hypothesis of these authors[21] was that in normal adults, retention of what was termed low imagery (text descriptions without pictures) decreases over time because images stored in long-term memory are accessible only through verbal labels. The experimental group was exposed to pictures and then asked to draw pictures or provide written one-word descriptions.[21] The control group was presented with words only and also asked to draw pictures or recall the words. Retention was tested immediately after showing the subjects the images or words, and then again at

48 hours. Purdy and Luepnitz[21] determined that recall of pictures was superior to that of text, and better for both groups on immediate posttesting.[21] This finding supports our notion that the screensaver would provide the initial appeal, repetition, and desire to access the website. Furthermore, as our formative research indicated, the proper orientation of graphics and text within the site prompted the user to continue in the investigation process.

Clayden and Wilson[22] discussed the advantages and difficulties associated with computer-assisted learning in medical education and categorized computer learning programs by trends in pedagogical methodologies and free manipulation of educational material that can only be achieved by the use of a computer. Traditional didactics do not allow for the learner to pause at will and review information outside of the provided materials, and do not always provided a choice in format for presentation. Computers do offer this advantage, which provides another strength in our innovative approach.

As medical information grows exponentially, the need to disseminate information as it becomes available also increases. Internet education opens the opportunity for flexible instruction techniques and learning with a wide range of possibilities to both establish and maintain competencies and provide professional accreditation.[22]

Outcome Evaluation

Although both clinicians and health care organizations have welcomed medical education through the Internet, few studies have been able to determine the utility of this method in comparison with conventional classroom teaching strategies through objective outcome measures. Fleetwood et al.[8] in a study of 173 American medical students taking

a bioethics course, found that a computer-based program augmented classroom experiences. Appropriate communication skills with ethical reasoning are mandatory in managing clinical-practice dilemmas, and the classroom only provides an environment for small-group work and lecture-based material. Learning modules with "simulated patient encounters" permitted the students to interact with virtual patients in identifying dilemmas, analyzing issues, and forming effective resolution. [8] Using overall final examination grades as the evaluation tool for the effectiveness of the computer modules, this study[8] clearly concluded that the simulated patient interaction engaged the students, allowed self-paced learning, adapted well to scheduling and location, enhanced timely feedback with instructor(s), afforded tracking of comments and questions, and overcame group variability from students and facilitators."

A randomized, controlled trial conducted by Chan et al.[23] suggested that Internet discussion groups in contrast to small classroom groups can be used in CME for family physicians. Chan et al. [23] suggested that the former groups might provide better ways for an instructor to identify learner needs by threads of communication and questions based on case scenarios. The study, [23] which used case-based scenarios and multiple-choice-question formatting with web-based communication between faculty and participants, also confirmed that in traditional small-group learning, the mere presence of a facilitator may dominate the learning process and may not be the best setting for accurate assessment of learning objectives. The use of the Internet gave a mechanism for faculty to insert additional lines of questioning to challenge learners in areas they have "not identified themselves." [23] The nonthreatening and unobtrusive manner in which faculty and students could communicate about the questions and discuss cases via the Internet

was concluded to be the greatest advantage of this method. Although Chan et al. [23] did not find this method superior to other methods in knowledge gains, the use of the qualitative communication threads as an outcome measure was significant in supporting web-based instruction. The proposition of web-based education over learning within the confines of the teacher-facilitated environment is a direction for future investigation, specifically in assessing knowledge gains with course content that is designed to be delivered individually.

The shift from merely teaching to learning has been recognized in recent educational interventions. The goal of web-based learning in medicine is to teach a "process rather than a large accumulation of facts that can be tested easily using paper-and-pencil examination."[24] As Liptman et al.[24] discovered in their prospective, randomized study of a sophomore medical school course in clinical ethics, the benefit of Internet teaching vs traditional methods has not been firmly established in the literature. Woo and Kimmick[11] claim that the failure to identify a "gold standard," given the current state of technology of instruments for evaluating computer learning, can be largely based on the idea that use of the computer automatically increases achievement. Learning can not be assumed simply because a new delivery method is used, therefore the current researcher suggests that evaluating computer instruction must first be geared toward levels of satisfaction with accountability for variables such as motivation for use, learning styles most conducive to this delivery method, proficiency in general computer use, and effects on self-efficacy.

If web-based learning is a process as opposed to a stimulant for learning itself, then evaluation should control for the individuality of users when relevant outcome

measures are chosen. This literature review found this control lacking as well. Although most computer-instruction research reported the "value" of the method by testing or retrospective surveys, they acknowledge that evaluations should include the level of participation, amount of critical-thinking skills employed, and amount of self-directedness that occurs rather than solely using test scores, which were a common thread in the quantitative articles reviewed. McNulty et al.[25] found in evaluating a web-based science course that one of the ways to infer participation is through accumulation of website statistics or "hits." In a study[25] of 124 first-year medical students in a basic science course, student surveys assessing computer proficiency, frequency of use, and satisfaction with a computerized version of the course was compared to the server statistics of login frequency and length of login time. McNulty et al.[25] documented the importance of using the objective, quantitative data provided by "hits" in evaluating web-based applications in medical education and concluded that user access correlated with academic performance in the course. Another significant finding was that computer proficiency of the student before matriculation did not predict use of the website, a positive finding when considering expansion of computerized instruction to an inexperienced or even disabled user. Specific material acquisition and testing at the individual user levels can be easily obtained through server statistics[25] and can be valuable both in process and in outcome assessments.

Variations of PC hardware configurations and connections were also correlated to the efficacy of web-based educational programs. Sekikawa et al.[26] found that download speed as an independent, categorical variable in evaluating an Internet epidemiology course was strongly related to the perception of the course quality by the user. Slow

download means more time, and more time may increase dissatisfaction. The satisfaction of the learner with the modality can also be reflected by how the download speed can affect image quality,[27] which is already established as an important factor in repetitious learning. In an examination of preferred radiographic image delivery, third-semester dental students were assigned to 2 groups.[27] One group was shown slide-tape presentations of the images, and another was shown the image on a web page. The dental students not only preferred the digital quality the image on the web page but also preferred web page delivery because of accessibility, ease of use, and navigation. The authors[27] recognized that a challenge to presentation in their study was transmission speed. Connection speed and server capacity issues could "impede the learning process or at least reduce learner enthusiasm."[27]

Regardless of whether digital or wireless connection vs a dial-up connection is being used, consideration of the Internet service provider, the server capacity, and the PC processing capabilities must be taken into account when appealing to the user. These aspects could easily be a barrier to widespread dissemination and warrants further investigation. It would be impossible to control for these variables and determine the effectiveness of an Internet-based intervention, where remote access is worldwide.

Another consideration in evaluating the outcomes of computer learning is the content of the program and the credibility of the information. The Health On the Net Foundation, a voluntary organization, has implemented a code of conduct for medical and health websites, however no guidelines exist for assuring the user that the sources are credible[28] in the absence of readily recognized professional references.

Focus Groups as Research Tools

An innovative approach to education should compact information without losing quality of content while giving appeal to the learner in such a way that the approach is preferred. Determining the most enticing qualities of a novel intervention involves an understanding of the targeted participants' attitudes, perceptions, and opinions. The use of focus groups, a common tool in marketing, provides investigators with ideas of how group attitudes are formed; and thus, decisions are made to use or not use a particular product.[29] The findings of Chumley-Jones et al.[9] lend value to the proven educational theory that delivery must be based on identified learners' needs rather than on the assumption that integrating technology must make delivery better.

Assessing learner stimulation and preferences is most likely derived from focus groups, a method not employed (or at least not discussed) in any of the literature reviewed but one we considered to be an effective means of ensuring the success of our pilot. Focus groups have been widely used in the social sciences, both in planning and in process evaluations, educational and nonprofit organizations have traditionally used face-to-face interviews and questionnaires to get information."[30] These tools, although appropriate in some instances, may fail to reveal to researchers why decisions are made relative to an intervention, which can be critical in identifying needed changes to a project to bolster receptivity.[29] Kevern and Webb[31] support focus groups as a nursing research tool stating that these groups are an effective way to gain insight into the "collective conscious," and a functional method of data collection"[31] connecting the researcher with group perspectives and experiences that may be unexplored by other methods." Both of the focus groups employed during the formative stage of our pilot

provided valuable information needed to increase the allure of the screensaver and enhance navigation of the website, which was particularly useful because we knew the intervention was subject to selection bias.

Implications for Educators

BT training is expected to require regular updates as new information is processed through local and federal public health authorities. To be timely in training efforts, preparedness education for clinicians must be a "continual" process, with updates readily available to practitioners. We found the following aspects perhaps the most challenging task of our project: maintaining the site through concurrent evaluation, providing updates, and securing related funding. The amount of information needed to adequately address clinician training is far too large a task for traditional educational approaches. As the literature suggests, web-based education offers quick-reference and voluminous stores of information that are easily updated and linked directly to care delivery at an individualized pace. The challenge to educators should be to develop programs at the point of care that are not confined to infrastructure computer systems (Intranet), so that information can be collaborative when needed. This would require reallocation of educational resources such as expanding capital budgets to improve networking capabilities, programming, and maintenance. Regular updates as an integral part of program maintenance can be tedious and difficult; however, when done in conjunction with good process and continued research and the evaluation of outcomes, the updates can encourage practitioners to hone decision-making skills and develop clinical expertise for management of a BT event.

Summary

Several trends were discovered in the analysis that related to our pilot. Almost all of the articles advocated the use of computers as an alternative or adjunct to traditional teaching and discussed the effects of web-based learning on instructional techniques. Surprisingly few studies (noting studies conducted with practitioners) focused on the need to demonstrate how computer learning translates into practical application. This aspect was of particular interest because the interpretation of BT training could only be demonstrated by the management of an actual BT event. Similarly, not one of the articles reviewed presented the use of focus groups as a qualitative research tool in the planning of their projects. Focus groups are an invaluable tool in assessing a target audience's attitudes, perceptions, and behaviors; these data were critical to the formative stage of our project and we considered their incorporation a strength of our program not readily found in traditional education research. The limited availability of published comparative studies using traditional education-delivery models was apparent, but the current literature suggested that employment of technology to promote learning must be founded in established pedagogical principles. Most of the authors concluded that future directions for study should include improved methods of outcome evaluation for computerized instruction. In addition the cost-effectiveness of computerized instruction needs to be investigated further.

PILOT DEVELOPMENT

The Task Order Working Group

This project was funded by a grant provided by the Agency for Healthcare Research and Quality. The development of the educational objectives for the different specialties required collaboration of program personnel, not only to identify specific priorities for BT education unique to the disciplines but also to determine specific outcome measurements appropriate for the area of practice. A task order group was organized to ensure comprehensiveness and content validity of the program through the collaborative efforts of many disciplines. Although some members consulted were affiliated with other governmental institutions, the group mainly consisted of professionals who specialized in the many components of the program within various departments at the University of Alabama at Birmingham (UAB) such as emergency medicine, education, computer programming, nursing, public health, and epidemiology. Selected members of the group composed various pieces of information contained within the site such as the differential diagnosis table, specific agent information, and more detailed information on each of the included agents. In addition to the writing of content, members selected and approved all graphics. Because diagnosis of certain agents requires consideration of multiple criteria not limited to the laboratory, the inclusion of the photographs of patients, microbiological slides, and radiographs was necessary. After compilation of materials for the assigned area, the entire group reviewed the materials for

content, grammar, and presentation. The group was further subdivided according to medicine and nursing for the purpose of developing continuing education (CE) module questions. As with other areas of the site, the group reviewed the CE questions for content and application according to discipline. A computer subcontractor was then selected to provide technological applications of the project content in coordination with the task order group.

Educational Objectives Development

The overall goal of the project was to improve the hospital-based clinicians' ability to recognize a BT outbreak; however, no assessment tool could accurately infer the recognition of BT event recognition (outside of an actual event) independent by completion of the CE modules. Therefore, educational objectives were designed to address the effectiveness of CE testing. Objectives for the CE component of the site included correct answers to the standard CE formatted clinical questions targeted to the area of practice chosen by the user. Questions included case vignettes for identifying and treating *Bacillus anthracis*, Variola, emerging infections, five common syndromes that may be associated with BT outbreaks, infectious diseases for which reporting is required, and the steps for reporting such diseases to the CDC.

This project, which successfully demonstrated the dual use of the computer in delivering education through an Internet-linked screensaver presented opportunities for developing nontraditional pedagogical objectives with relative evaluation tools.[4]

We recognized at the outset that any assessment of this technological intervention must be sensitive to user profiles such as knowledge levels and abilities according to specialty,

attitude toward the delivery method, and motivations for use. To ensure this level of sensitivity, sound pedagogy with user-friendly computer application was applied with measurements independent of the user's level of computer proficiency.

In 1988, Clayden and Wilson[22] described computer-assisted learning in medical education through basic educational principles that assist in describing the formation of our objectives. The CE modules of the program were designed to test knowledge and critical thinking skills at the learner's individual pace. Methodology grounded in behavioral psychology provided a sound rationale by including positive reinforcement with immediate pop-up text boxes for remediation when a multiple-choice answer was chosen. If an incorrect answer was selected, a reason the answer was not correct was provided, leading the user to select another answer. Clayden and Wilson[22] states that "while it may not be important to be constantly successful in learning, it is important to know whether one is being successful or not." The remedial looping of the modules allowed the user to ascertain results immediately, which we think facilitated further participation in the learning.

Evaluation

After development of the objectives, an evaluation matrix quickly evolved to establish needed changes as well as future measurement options. Creating this matrix was perhaps the most daunting task of the program because evaluation techniques, specifically in Internet applications for medical education, are currently fertile ground for research.

Before to piloting the program, the current investigator obtained process evaluation of the pilot by collecting feedback from individuals in a variety of disciplines such as emergency medical technicians, nursing, laboratory workers, physician assistants, and health educators through the use of a random questionnaire and focus group. At the April 2001 State of Alabama Emergency Management System and Disaster Preparedness Conference, two versions of the screensaver were displayed on laptop computers. One version contained only graphics of smallpox and anthrax and no text, and the other contained the same graphics but included textual prompts such as "can you identify this organism?" Conference attendees who browsed the screensavers were asked a short list of questions that provided an evaluation of the graphics, the content, the preference to have the screensaver in the workplace, and whether the screensaver promoted a desire to learn more. The appendix contains the instruments used by facilitators in the focus group discussions. As a result of the conference findings, we made a few minor changes in the graphics of the screensaver, (the size of print, color of fonts, color of background and placement of hyperlink to the website) and conducted a focus group in July. The group, composed of professionals and students from UAB Hospital, School of Nursing, and School of Public Health, was gathered in a computer laboratory to assess the screensaver and peruse the linked website. Participants interacted with the program by evaluating graphics, ease of navigation, content of educational material, general presentation, and preference to have the screensaver installation in their workplace. As a result of positive focus-group responses, final adjustments were made to the screensaver by August 2001 and plans for emergency department installation were made by September 2001.

BIOTERRORISM PREPAREDNESS GUIDELINES

The uses of biological agents as weapons of warfare have been recorded throughout history. As early as 1346 B.C., corpses of plague victims of the Tartar army were taken into Crimea, forcing the surrender of Crimean forces.[32] Survivors unknowingly carrying the disease were said to have fled into Europe, which may have precipitated the Black Death. Similar incidents have been documented throughout the centuries; and as the field of microbiology advanced, even more sophisticated bioweapons were developed. For example, after World War II, investigation revealed that a laboratory in Japan known as Unit 731, which operated from 1937 until about 1945, researched numerous organisms with prisoners of war as test subjects. In 1969, President Nixon, by executive order stopped production of all offensive biological weapons and toxins. Remaining stockpiles in the United States were destroyed under the supervision of various US government monitors.[32] Despite the treaty known as the Biological Weapons Convention that was ratified by over 140 countries, the use of biological and toxic weapons has continued in some countries. From reports of multi-colored aerosols in Vietnam[32] to the recent exposure of Iraq's repositories, the threat of biowarfare is ever present.

Various governmental and professional organizations have recognized the role of hospital facilities in preparedness and affirm that first response might very well occur in emergency rooms.[33] Most hospital disaster plans were designed to handle short-duration, light-to-moderate-volume casualty management and have less than adequate strategies to

sustain care in the event of a mass casualty incident.[33] To address the need for providers to have some sort of framework with which to develop comprehensive response plans, recommendations for preparedness were developed by the American Hospital Association (AHA); also, guidelines for disaster protocols have been offered by the CDC in collaboration with the APIC. After considering federal and state mandates for preparedness, an additional framework is provided by the US Army for Medical Research Institute for Infectious Disease, (USAMRIID) through the so-called Blue Book. These documents, in conjunction with the approaches delineated by the AHA are perhaps the most widely used and accepted among most US facilities as a foundation for responses to BT planning. Although these templates require modification to tailor the protocols to the unique characteristics and setting of a facility, each of the documents commonly resonate that successful management of an event depends on education. These guides provide an excellent frame on which to build preparedness plans and serve as a quick reference of individual agents with a high potential of use in such an event.

In March 2000, the AHA convened an "Invitational Forum on Hospital Preparedness for Mass Casualties,"[33] to develop a consensus on how hospitals can effectively respond to the unprecedented possibility of a terrorist event. The AHA resolved that hospital disaster plans historically did not incorporate a focus on community-level planning and failed to include alternate planning for the scenario in which the hospital becomes the victim, in which evacuation, quarantine, or patient diversion may be required.[33] This report of the association presents four major focal points about which hospitals should be prudent in developing disaster protocols: community-wide preparedness, staffing issues, communications, and public policy.

"Hospitals, because of their emergency services and 24 hour-a-day operation, will be seen by the public as a vital resource for diagnosis, treatment, and follow-up for both physical and psychological care."[33] Mass casualty incidents have the potential to overwhelm a hospital's ability to provide appropriate care and may be compounded by etiologies not readily recognizable to most clinicians. In short, the AHA suggests that facilities expand their focus for preparedness to include community-level resources.[33] This expansion not only will enhance community preparedness but will facilitate better communication with other providers and emergency services should patients be diverted because of capacity issues, quarantine, or evacuation.

Staffing of hospitals is perhaps the largest hurdle administrators must overcome in disasters and is the first issue to present potential hardship in a mass casualty occurrence. As an integral part of a community-level effort, the AHA suggests identifying auxiliary staff or "reserve staff" such as retired clinicians that can substitute as bedside practitioners, allowing regular staff to handle disaster victims.[33] Licensing bodies, in collaboration with state boards and facility credentialing committees, must adopt and amend policies to encompass emergent staffing situations and should share this information among peers within the community.

Communications within a community may also be overwhelmed in a mass casualty event. Land-based phone lines, as well as wireless connections, may be compromised as responders and victims a like scramble to establish contact with one another. Alternate systems with a single point of contact for locating patients are needed and must be adequately tested and drilled.[33]

Perhaps now, more than ever before in history, hospitals' resources are challenged not just by increasing levels of morbidity and questionable financial climate but by

prospective-payment systems and governmental mandates revolving around patient care issues. Given the financial status for most hospitals, there is a clear need for extensive training, education, structural modifications, equipment, and supplies. The AHA posits that the "Emergency Medical Treatment and Labor Act (EMTALA) needs to be refined to establish [safe harbor] provisions so that a hospital assigned a role of caring for unexposed patients does not have to violate either its status as a [clean] facility or its EMTALA obligations."[33] The association continues to suggest that congressional support for assisting hospitals in disaster relief include funds to compensate for economic loss rather than providing funds exclusively for property damages.

The Bioterrorism Readiness Plan;[34] A Template for Healthcare Facilties[34] created by the CDC Hospital Infection Program Working Group in conjunction with APIC, is designed as a rapid reference into one main section discusses planning and a second section focuses on agent-specific information.

The first subsection[34] reminds the facility that hospital emergency rooms may be the initial site for recognition of an event; contact and report requirements both to public health and to law authorities as well as to inter-facility personnel, are provided. The next subsection of the template describes BT events as potential or actual. The primary focus of "detection of outbreaks caused by agents of bioterrorism" is rapid response to high-risk syndromes, agent-specific diagnosis, treatment, and containment information is provided. Within this section, a complete and comprehensive list of epidemiologic characteristics of a BT outbreak assists the practitioner in quick assessment such as

- Increased incidence of disease in an otherwise healthy population
- An epidemic curve that spikes and declines sharply over a short period

- Clusters of patients from a single locale
- An endemic disease that presents at an unusual time

The next subsection of the template[34] gives an overview of infection control management and basic techniques. The overview includes standard precautions, supply considerations, the need to cohort patients with like-diagnoses, transportation, equipment cleaning, discharge planning, post mortem care, decontamination, prophylaxis and vaccination, and psychological management.

The next portion of the document[34] presents laboratory certification by diagnostic capabilities and suggests coordination with public health authorities to refine strategies for sampling. The last subsection[34] describes directions for flow of communication within a facility and advises careful coordination with media officials to eliminate possible misunderstandings and decrease escalation of community fear.

Section II of the manual[34] presents four diseases categorized as "A" according to the CDC (presented elsewhere in this report): anthrax, botulism, plague, and smallpox. Each agent is addressed according to etiology, symptoms, mode of transmission, preventive measures, IC precautions for patient care, postexposure management, laboratory support, and public information suggestions. The template concludes with voluminous references and a list the contact numbers of state health officers of all the 50 states, federal investigation field offices of the Federal Bureau of Investigation, and contact numbers and website addresses of other national support organizations.

The USAMRIID manual, also known as the Blue Book, has been published since 1993. The manual has been widely distributed among military and civilian health care providers as a companion to the institute's Medical Management of Biological Casualties course that is offered both at the site and through satellite broadcasts. The USAMRIID

manual, organized much like the CDC/APIC template, differs in that the former manual provides a more detailed history of biological and chemical warfare; distinguishing features of related epidemiological investigations; expanded information on the management of agents grouped by bacterial, viral, and biological types; and detailed appendices regarding medical terminology, vaccines, specimen collections, comparative charts of agents, and voluminous references. Because of these differences, many health care facilities have opted to consult both the CDC/APIC template and the USAMRIID manual in the development of disaster planning to encompass a wider variety of agents, determine the utility of alternate field treatment modalities (if different from other standardized guidelines), and expand tables of differential diagnoses.

The challenges for BT preparedness have never been faced by hospitals. No one can predict where or when a disaster of this nature could strike. Successful management of an incident depends on vigilant, knowledgeable staff that has access to appropriate resources. Preparedness must start with education. These guides offer hospitals a clear and concise multidisciplinary framework that encompasses every aspect of the coordination and care of victims.

AN INNOVATIVE APPROACH TO TRAINING HOSPITAL-BASED CLINICIANS FOR BIOTERRORIST ATTACKS

by

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Until the events of September 11, 2001 and the subsequent anthrax outbreaks of the same year, few health care organizations viewed integrating BT preparedness into existing disaster plans as a high priority. Despite the fact that biological agents as weapons of mass destruction have presented a threat before the fall of 2001, the challenge to educate hospital-based clinicians, including infection control practitioners (ICPs), in an effective and timely manner quickly gained precedence after the events of that fall.

Educational strategies aimed at preparedness for the event of BT attacks have traditionally focused on enhancing disaster preparedness training of first-responders such as emergency medical technicians, police, and firefighters. Furthermore, the Centers for Disease Control and Prevention (CDC) identified public health workers as potential primary contacts in detection, as opposed to hospital-based personnel. These first-responders and public health workers do not function independently of medical facilities and other health care personnel in the community in addressing the detection, containment, and treatment of unusual agents. The initial detection and confirmation of illness often rely on the skill of emergency room nurses, physicians, and hospital laboratorians. This reliance is especially true when one considers that victims may barrage local emergency rooms without the intervention of emergency medical technicians. In fact, as the sarin-nerve-gas-attack in Tokyo and recent New York tragedies demonstrated, local EDs may be the first point of contact for community members who are concerned that they have been exposed to dangerous chemicals or biological agents.[16]

The potential for future BT encounters and the fast-paced climate of health care delivery climate have increased reliance upon ICPs for training and collaboration within organizations and the community.[36] Moreover, hospital-based ICPs are usually the

primary resource for EDs when risk assessment and appropriate infection control precautions must be implemented. The knowledgeable response of the ICP is a vital link to ED personnel to ensure appropriate precautions for infection control are implemented in a timely manner. Some of the tasks identified for the content outline of the certification examination of the Association for Professionals in Infection Control and Epidemiology, Inc. (APIC) (under the category of Program Management and Communication), include "serve as a liaison among the health care facility, medical staff, and community,"[35] "act as an infection control liaison with public health authorities," and "provide consultation to administration, committees, and department managers on issues relating to infection control."[35]

Because BT agents used in terrorist activity may be initially misdiagnosed as syndromes of more commonly recognized diseases such as influenza, it is imperative that clinicians be knowledgeable in diagnoses other than prevalent syndromes. Furthermore, clinicians must be able to think critically in terms of epidemiological consequences, be prepared to implement appropriate monitoring procedures for emerging infectious agents, consider diagnostic and treatment options, and employ appropriate IC precautions pertinent to the identified or suspected agent.

METHODS

The pilot project reported here was designed to educate clinicians in event detection, diagnosis, treatment options, and appropriate IC measures for BT agents by using an innovative approach. With limited time available for traditional educational methodologies, the use of easily accessible and highly visible technology is appealing as an educational solution. Because the majority of technology-based educational

applications focus primarily on web-based training, this program established screensavers as the vehicle to increase awareness of and, thus, facilitate subsequent participation in web-based education. The use of interactive screensavers has not been thoroughly researched in the context of application as an educational tool. Hospital-based clinicians are usually within the proximity of a computer even if not using the computer therefore, the novel approach of the program is to entice the casual viewer with high-quality photographs of patients, radiographs, and histology specimens and with provocative questions to promote further interest and provide educational translation of the graphics. The screensavers, which rotate images and text, have striking visuals that serve as a billboard to persons working at or near the computer or merely passing by the monitor. To prevent desensitization to exposure to the screensaver, this tool may be updated easily by changing images and textual prompts. The screensaver, which can be downloaded to multiple sites by large numbers of personal computers (PCs) or networked PCs, may also be directed by the user to access the website with additional BT information and web-based learning modules relevant to practice areas of specialization.

The development of the objectives for the different specialties required collaboration of program personnel not only to identify specific priorities for BT education that is unique to the disciplines but to determine specific outcome measurements that are appropriate for the area of practice. The Task Order Working Group ensured comprehensiveness and content validity of the program through the collaborative efforts of many disciplines throughout various departments at the UAB. Key individuals representing these departments have expertise in a range of areas. The group consisted of professionals who specialize in the many components of the program such as emergency medicine, educational content, computer programming, nursing,

public health, and epidemiology. A computer subcontractor provided technological applications of the educational content in coordination with the task order group.

The website developed for this project, in June 2002, contains information in a quick reference format on CDC category A agents. These agents are identified as potential BT weapons that are capable of mass casualties, requiring specific public health preparedness.[5] Because the diagnosis of certain agents requires consideration of multiple criteria not limited to the laboratory, the inclusion of the photographs of patients, microbiological slides, and radiographs was necessary. A differential-diagnosis table and additional detailed information specifically on anthrax and smallpox is provided. The learner may peruse the site for background information on the biological agents, recommended treatment, and reporting links, and then proceed to CE modules that present case simulations with multiple-choice responses and immediate pop-up text boxes for remediation. The on-line CE modules, tailored to specialty areas, include emergency physicians, IC personnel, pathologists, and radiologists to date. Plans for the website and CE modules include the addition of emerging infections such as the West Nile virus and other BT agents distinguished as category A.

Before to piloting the program, the investigators used a random questionnaire and a focus group to provide feedback from a variety of disciplines such as emergency medical technicians, nursing, laboratory workers, physician assistants, and health educators. At the April 2000 the UAB Center for Disaster Preparedness Conference, background visibility, and placement of hyperlink to the website), a focus group comprised of professionals and students from the UAB Hospital, School of Nursing, and School of Public Health were gathered in a computer laboratory to assess the screensaver and linked website. Participants interacted with the program to evaluate graphics, ease of

navigation, content of educational material, and general presentation. As a result of the focus group's responses, final adjustments were made to the screensaver and plans for ED installation were made.

RESULTS

During the months of March through September 2001, before to installation of the screensaver on ED worksite computers, ED medical student rotators from the UAB Hospital, a 40,000 visits/year urban medical center, were pre- and posttested for general BT knowledge with the educational module questions from the website ($N = 50$). Pre- and postrotation scores were 38.8% and 52.4%, respectively (paired t-test, $p = .0097$). After installation of the program, pre- and post-rotation scores for October through December 2001 were 59.1% and 75.8%, respectively (paired t-test, $p = .0110$). There was a 20.3% increase in baseline knowledge after the events of September-October 2001 in the pretest and a 23.4% increase in the posttest; however, the overall increase is a statistically non-significant trend favoring the intervention. (All computer placements were visible to only ED staff.)

Given the events of 9/11, it is unclear what proportion of the increase in baseline scores was caused by the effect of the screensaver; however pre-9/11 pilot testing and focus groups provided evidence that the screensavers did attract attention and lead to subsequent contact with the website. At the time of the project implementation, it was not anticipated that an actual event would occur to contaminate findings of the study, however, despite public discussion of potential BT attacks after the New York tragedy, the anthrax cases were not reported in the mass media until early October 2001, after post-testing of the ED rotators. It was concluded that this innovation substantiated the

approach as an effective alternative to costly and time-consuming educational modalities, but further research is indicated for screensavers and their application to continuing medical education (CME).

DISCUSSION

Until recently, adequate hospital responses to biological disasters were merely speculative and based on existing policies and procedures. Although exposure to some chemical incidents has afforded hospitals the opportunity to test existing plans and identify needs to coordinate with other local public health organizations, results of such testing may have limited value to the management of a BT event.[36,37] To avoid secondary exposures and possible closure of local EDs[37] and facilities, the rapid and appropriate response of medical facilities in collaboration with first responders is critical in limiting casualties. One of the most significant aspects of an appropriate response begins with elevating the level of suspicion by initial health care points of contact in the setting, including the ICP.

As many clinicians become involved in areas of specialization, the recall of public health courses may decrease. This decrease can further intensify reliance on ICPs for information, as well as diminish the appeal of traditional educational methods. The content of BT programs must be able to engage practitioners to facilitate the learning process in such a manner as to make the experience positive and, most important must be streamlined to fit into the busy schedules of the practitioners. Literature on the delivery of learning interventions as published within health and social sciences indicates that the most effective training programs include the use of multiple modalities, with an emphasis on repetitious problem solving, increasing self-efficacy to act on suspicion, simplicity of

materials, and cost-effectiveness.[38] These modalities must fit among the demands of patient care, administrative duties, and CE within specialty areas. With this in mind, the incorporation of interactive screen savers to initially gain the attention of the clinician at the worksite provided a novel method to increase desire for further inquiry.

At the 2000 annual meeting of the APIC, focus groups were conducted to identify which educational delivery methods were preferred for BT training for clinicians.[4] The focus-group results determined the need to include the use of Internet technologies, the need to implement a variety of methodologies, a demand for cost-effectiveness, and a desire for updated quick-reference materials.[4] The pilot project reported here integrated all of the priority areas identified by the recommendations of the APIC focus group.

In view of the events of the fall of 2001, it became apparent that there is a need to educate hospital-based clinicians in the event of BT attack. The prospect of "whether' a BT event will occur[4] has been replaced by crucial analysis of how well prepared we are to handle a reoccurrence. Pondering "low-probability, high consequence"[5-7] BT events is no longer acceptable. First-responders have traditionally been the target for most educational programs in this area; however the expansion of training to all potential medical responders and specifically to hospital workers has been initiated nationwide. Because anyone in the hospital setting can (and should) act on the suspicion of a BT event, this expansion of education is crucial in the recognition of questionable high risk syndromes, the isolation of the suspected agents and victims (to prevent a potential epidemic), and the use of non-traditional treatment for biological agents unfamiliar to many clinicians.

Technology offers a timely, cost-effective, and convenient way to address CME needs of personnel with limited time available for participation in traditional learning

activities. This project demonstrates the effectiveness of delivering BT education by integrating technology in a stimulating, efficient, and easily accessible manner.

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AN INNOVATIVE EDUCATIONAL APPROACH IN BIOTERRORISM PREPAREDNESS FOR CLINICIANS

by

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AN INNOVATIVE EDUCATIONAL APPROACH IN BIOTERRORISM PREPAREDNESS FOR CLINICIANS

The events of September 11, 2001, and the subsequent anthrax outbreaks of that year presented health care organizations with the necessity to refine disaster plans with the integration of BT preparedness and the challenge to educate clinicians in an effective and timely manner. Early in the fall of 2001, before to the terrorist attacks in the United States, a pilot project funded in part by the Agency for Healthcare Research and Quality sought to deliver education on biological agents identified as potential weapons of war by using an innovative approach. The potential for future BT attacks exists; in view of the fast-paced climate of health care delivery, increased responsibilities of clinicians, and limited time for traditional educational methodologies,[1] the use of easily accessible and highly visible technology is a logical approach. Because the majority of technology-based educational applications focus primarily on web-based training, this program sought to establish screensavers as a vehicle to increase awareness and, thus, facilitate subsequent participation in web-based instruction.

Educational strategies aimed at preparedness for the event of BT attacks or emerging infectious disease have traditionally focused on first-responders such as emergency medical technicians, police, and firefighters.[2] These first-responders do not function independently of medical facilities and other medical personnel in the community in addressing detection, containment, and treatment of unusual biological agents. In fact, as the sarin-nerve-gas-attack in Tokyo and the recent anthrax cases demonstrated, local EDs may be the first point of contact for victims of biological agents[3] who may be unaware of their exposure. Until recently, adequate hospital responses to

exposure to some chemical incidents has afforded hospitals the opportunity to test existing plans and identify needs to coordinate with other local public health organizations, results of such testing may have limited value to the management of a BT event.[4] To avoid secondary exposures and possible closure of local EDs and facilities, rapid and appropriate response of medical facilities in collaboration with first responders is critical in limiting casualties. One of the most significant aspects of an appropriate response begins with elevating the level of suspicion by initial health care points of contact in the setting.

Because these biological agents used in terrorist activity may be disguised as syndromes of more commonly recognized diseases such as influenza, it is imperative that clinicians be knowledgeable in diagnoses outside of commonly detected syndromes. Furthermore, these practitioners must be able to think critically in terms of epidemiological consequences, be prepared to implement monitoring procedures for emerging infectious agents, and consider diagnostic and treatment options pertinent to the identified or suspected agent.

As many clinicians become involved in areas of specialization, the recall of public health courses may decrease. Therefore, any program to educate clinicians on BT must re-emphasize the basics of biology and epidemiology. The content of such programs must also engage practitioners to facilitate the learning process in such a manner as to make the experience positive and, most important streamlined to fit into the busy schedules of clinicians. Research indicates that the most effective training programs include the use of multiple modalities, with emphasis on repetitious problem solving, increasing self-efficacy to act on suspicion, and simplicity of materials. These modalities must fit among the demands of patient care, administrative duties, and CE within

specialty areas.[5] With these considerations in mind, the incorporation of interactive screen savers to initially gain attention of the clinician at the worksite provided a novel method to increase desire for further inquiry. The screen saver, when directed by the user, accesses the website with additional BT information and web-based learning modules relevant to practice areas of specialization.

The website at present contains information on exotic agents identified as potential biological weapons capable of mass casualties requiring specific public health preparedness. Because diagnosis of certain agents requires consideration of multiple criteria not limited to the laboratory, the inclusion of high-quality photographs of patients, histology slides, and radiographs was necessary. A differential diagnosis table and additional detailed information specifically on anthrax and smallpox is provided. The learner may peruse the site for background information on the biological agents, recommended treatment, and reporting links, and then proceed to CE modules that present case simulations with multiple choice responses and immediate pop-up text boxes for remediation. At present, the on-line CE modules, tailored to specialty areas, include emergency physicians, infection control nursing personnel, pathologists, and radiologists. Plans for the website and CE modules include expansion to additional emerging infections and other BT agents.

In view of the events of fall 2001, it became clear that there was a need to educate medical clinicians in the event of BT attack.[6] The mindset of "this will never happen in my community" is simply no longer acceptable. First-responders have traditionally been the target for most educational programs in this area; however the expansion of training to all potential medical responders is crucial in recognition of possible high-risk syndromes, isolation of the suspected agents and victims (to prevent a potential

epidemic), and nontraditional treatment for "exotic" biological agents unfamiliar to many clinicians. Technology offers a timely, cost-effective, and convenient way to address medical education; and the use of screensavers to offer more than entertainment and protection shows promise for future applications, specifically for personnel with limited time available for participation in learning activities.

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CONCLUSION

Although the effects of history may have hazed the validity of our pilot, we believe this project demonstrated a novel dual use of computerized instruction. Screensavers have been established as not just a mechanism to preserve monitor life but also a method of self-expression through backgrounds, text, and images of our choosing. This being said, it is only logical that screensavers may be used as a channel to communicate messages, particularly in an intranet system.

The dual-use technology of the screensaver is the initial enticement to engage the viewer and then provide a gateway to CE. Industry of all sorts is continuously developing strategies ways to improve employee communications and limit time that management must spend in attempting to drive down information to multiple staff levels. Screensavers displaying company logos, process improvement keywords, and business philosophy symbols serve as continuous reminders to employees and may even play a role in reinforcing employee expectations. As a method of conditioning viewers, screensavers not only inform but, as our pilot revealed, may be valuable in educating. This method of education is especially useful when time to deliver information is critical. The use of screensavers has far reaching effects outside the limitation of single-subject areas. In matters such as BT where multiple levels of staff must be informed, we have shown that this method is a viable option.

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APPENDIX

FOCUS GROUP INSTRUMENTS

Focus Group/Survey Questions

For these questions, the entire group will view the **screen saver** on the screen in the front of the room:

1. What caught your attention most about the screen saver?
2. What was the first thing you noticed as you began interacting with screen saver?
3. Was it easy to navigate from the screen saver to the web site?
4. Were the instructions (for pausing, exiting and going to the web site) clear?
5. Did you learn anything new from this screen saver?
6. If yes, please list top 1-2 items learned.
7. What did you like most about this screen saver?
8. What did you like least about this screen saver?
9. Would you be interested in having this screen saver in your place of employment?

For the next set of questions, the group will all be instructed to go to the **web site**. They may use a "dummy" e-mail address to 'log-in" to view the CE modules.

1. Was the site easy to navigate?
2. What did you think about the graphics?
3. Was the info on the site easy to read?
4. Was the info on the site clear?
5. Did the site encourage you to learn more about rare infections?
6. Did you learn anything new from the site?
7. If yes, list top 1-2 items learned.
8. What was your favorite page of the site?
9. What did you like most about this web site?
10. What did you like least about this web site?
11. Would you be interested in having this web site accessible from your place of employment?

Demographics of group

Home city
Occupation
Subspecialty (if applicable)
Age
Gender
Race
Level of education
Licensure (if applicable)

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DISSERTATION APPROVAL FORM
DOCTOR OF PHILOSOPHY

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Graduate Program Health Education and Promotion

Title of Dissertation An Innovative Approach to Training Hospital-Based Clinicians for Bioterrorist Attacks

I certify that I have read this document and examined the student regarding its content. In my opinion, this dissertation conforms to acceptable standards of scholarly presentation and is adequate in scope and quality, and the attainments of this student are such that she may be recommended for the degree of Doctor of Philosophy.

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