Developing web-based training for public health practitioners: what can we learn from a review of five disciplines?

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Abstract

During a time when governmental funding, resources and staff are decreasing and travel restrictions are increasing, attention to efficient methods of public health workforce training is essential. A literature review was conducted to inform the development and delivery of web-based trainings for public health practitioners. Literature was gathered and summarized from five disciplines: Information Technology, Health, Education, Business and Communications, following five research themes: benefits, barriers, retention, promotion and evaluation. As a result, a total of 138 articles relevant to web-based training design and implementation were identified. Key recommendations emerged, including the need to conduct formative research and evaluation, provide clear design and layout, concise content, interactivity, technical support, marketing and promotion and incentives. We conclude that there is limited application of web-based training in public health. This review offers an opportunity to learn from other disciplines. Web-based training methods may prove to be a key training strategy for reaching our public health workforce in the environment of limited resources.

Introduction

The public health workforce provides the fundamental services needed to ensure safe communities and enable individuals to live healthy lives [1]. Despite the importance of public health to the well-being of society, the workforce responsible for ensuring the public's health faces critical challenges, including substantial decreases in funding, resources and staff; inequitable distribution in areas of greatest need and inadequate training [2].

The Institute of Medicine defines a public health professional as 'a person educated in public health or a related discipline who is employed to improve health through a population focus' [1]. Public health professionals may share a population focus on health but they are employed across multiple types of settings and represent a range of disciplines, skills and educational and training backgrounds. The composition of the public health workforce is not easily defined or measured. It is a very diverse workforce, found in many settings and providing a wide range of services. Of the estimated 500 000 individuals that constitute the public health workforce, the majority (about 85%) are employed at governmental public health agencies, including the nearly 3000 local health departments, 56 state and tribal

agencies, and the many federal agencies responsible for public health [3]. The remaining 15% of the public health workforce are employed at non-profit organizations, academic and research institutions, medical groups and hospitals, and private companies [2].

Not only do we have an increasing shortage of public health workers, public health organizations have been hit hard in the current recession, with more than 19% of the public health workforce lost to cutbacks and layoffs since 2008 [4]. It is estimated that 44% of local health departments across the United States have experienced budget cuts since 2008. During this time period, these organizations have faced new demands (e.g. new infectious disease, addressing childhood obesity). More is expected of the public workforce despite worker shortages and declining resources [5, 6].

Unlike other fields of health, there is no one typical career path or academic preparation for public health [7]. Many public health workers at state, local, territorial and tribal health departments lack adequate education and training. A 2001 Centers for Disease Control and Prevention report found that four out of five public health workers had no formal training for their specific activities [8]. In recent years, only 20% of graduates in public health have entered careers at public health departments [7] contributing to an aging workforce. More than half (57%) of state health agencies' 2009 budget for workforce training and development decreased in 2009, and 30% were anticipating decreases in 2010 [9]. Continuous learning or in-service training is less common among local health departments; fewer than half of local health departments have a budget line item for staff training [10]. Despite the need, there continue to be few training opportunities for the existing public health workforce [5, 11, 12]. The range of activities and services public health workers provide requires that the workforce be experienced, motivated and well trained. Attention to public health workforce development is essential to ensure that there are a sufficient number of trained professionals entering the

work force and that relevant continuing education for these professionals is accessible.

Traditionally, public health practitioners have been trained using a traditional, face-to-face classroom delivery method, but is this the most efficient or effective training method, or can modern technologies allow new approaches? During a time when governmental funding, resources and staff are decreasing and travel restrictions for public health staff are increasing, it is important to identify the most efficient and effective way to train the public health workforce.

With the growth of the Internet, web-based training is a promising distribution channel for reaching a large number of practitioners. To fully understand the implications of moving from a traditional, face-to-face classroom delivery method to a virtual, web-based delivery method, we conducted a comprehensive literature review across five disciplines in order to present the rationale for use of web-based trainings and to identify the key components needed to guide development, implementation and maintenance of effective web-based trainings. As web-based trainings are gaining in popularity and necessity, we sought to identify components that comprise successful web-based trainings to inform and guide the development for our first effort to shift—to 'think outside the box' of traditional face-to-face public health training methods and to explore web-based training methods as an alternative. What we learned from this review informed the development of our efforts to train public health practitioners via the web. This article describes our process and findings in order to inform the broader public health context which may also be exploring the possibility of developing web-based trainings to ensure that our public health workforce is adequately trained in the midst of the challenges we now face.

Methods

To guide the literature review process, the project focused on five questions related to website use for online education.

To present the rationale for use of web-based training as opposed to traditional training formats:

(1) What are the benefits to users and organizations of web-based training?
(2) What are the barriers for users and organizations with respect to web-based training?

To guide the development, implementation and maintenance of web-based training:

(3) What are the essential components to retain users throughout the duration of the web-based training?
(4) What are the best ways to promote web-based training among various user audiences?
(5) What are the evaluation criteria used to determine the effectiveness of web-based training?

Data sources

We conducted an extensive literature review from five main disciplines, which were selected given their relative content and advances in web-based technology and training: Information Technology (IT), Health, Education, Business and Communications. This transdisciplinary approach provided insight into which components constituted a strong web-based training from a technology perspective (IT and Communications), a learner perspective (Education), a content perspective (Health) and an organizational perspective (Business).

We gathered resources through literature databases (e.g. PubMed, EBSCO, LISA, ERIC, Web of Science) and general Internet searches (e.g. Google Scholar). Journal articles from 1979 to 2009 were selected based on their relevance to the five research questions. Books, case studies and other resources supplemented information found in journal articles. Sixty keywords and combinations of keywords were used to locate relevant literature; using terms associated with web-based training and the research questions (Table I).

Table I. *Key search terms*

Key search terms	
Accessibility	Online training
Barriers	Online audience
Barriers to website use	Public health web site
Business	Public health internet use
Continuing professional education online	Public health professionals internet use
Communication	Professional online development
Designing distance education	Retention
Distance learning	Search engine optimization
E-education marketing	Successful websites
Education	Tailored health communication
E-learning	Traffic
E-learning usage	Technology acceptance model
E-learning planning	Training
E-learning program development	Uses and gratification theory
Elaboration likelihood model	Virtual learning environment (VLE)
Getting people to use a website	Visibility
Goal-based scenarios	Web traffic research
Health website use	Web-based communication
Health website promotion	Web-based curriculum
Internet	Web-based health
Internet marketing	Web-based health communication
Information technology	Web-based training (WBT)
Internet usage statistics	Website
Internet use	Website success
Internet traffic	Website marketing
Internet browsing behavior	Website use
Keys to websites	Website usability
Marketing	Website promotion tools
Motivation	Usability testing

Additional resources were identified through review of the reference sections of articles found to be relevant. Two web-based training professionals provided insight into the development of web-based trainings, the current literature available in the fields of IT, Education and Business and examples of model web-based training seminars and courses. These experts provided insight into the development of web-based trainings, the current literature available and examples of model

web-based training seminars and courses. The literature search was limited to information that could be gathered from libraries, online databases and search engines.

Study selection

We collected both research- and practice-based resources in an effort to examine information from both experts in the field of web-based training and 'real-world' organizations. Research-based articles (i.e. peer-reviewed articles that provided evaluation data) and practice-based articles (i.e. non-peer-reviewed articles that provided some evaluation data, findings or recommendations) were included, based on their relevance to web-based training. Articles were excluded if they were not specific to web-based training (e.g. commercial or shopping websites, Internet usage, Internet user demographics). Each article was reviewed by at least two reviewers to determine if the article met the inclusion criteria. The team met to discuss articles and addressed any discrepancies related to inclusion between reviewers. Final decisions were made in the team setting; reaching consensus was the goal.

Data extraction

Relevant data from each research- and practice-based article were extracted into five evidence tables: benefits, barriers, retention, promotion and evaluation criteria. Within each evidence table, data were summarized into key themes. Data from each of the articles were extracted individually by multiple reviewers, compared for accuracy, and where differences existed, consensus was reached. Key themes were those that were consistently addressed throughout articles.

Results

The initial search yielded 238 articles from the five disciplines. We retained 138 articles which met the inclusion criteria. The 138 articles relevant to web-based training design and implementation were gathered from 36 databases and search engines across the five areas: IT ($n = 48$), Education ($n = 27$), Business ($n = 28$), Communication ($n = 14$) and Health ($n = 9$). Twelve relevant case studies were also compiled. Reviewers searched for case studies from each of the topic areas. Those that addressed key themes were included. The majority of the literature sources concerning web-based trainings were found in the IT field. Information from Education and Business was evenly distributed, suggesting that web-based learning may be moving beyond distance education in universities to practical application in organizations. Little information was found in Health regarding web-based training. Of the 138 articles collected and reviewed across disciplines, 95 were found to be research-based while 43 were practice-based. Research-based refers to scientific, peer-reviewed articles or reviews that provide evaluation data or findings related to web-based training development and curriculum. Practice-based refers to resources that focus on recommendations and strategies for the development of web-based trainings as well as associated evaluation data or findings.

Benefits and barriers of web-based trainings to users and organizations

From our review we learned that both opportunities and obstacles exist for individual 'users' taking web-based trainings and also for 'organizations' that are implementing web-based trainings (Table II).

Benefits

There are multiple benefits to be gained from web-based trainings for both users and organizations. Web-based trainings provide easy access to widespread geographic areas accessible via the Internet [13]. They offer users great flexibility in the timing of their participation, and provide the opportunity for individualized learning [14, 15]. A significant benefit for organizations is a decrease in resources used to train employees, including time and costs associated with travel, meeting space and hiring trainers [15, 16]. Web-based trainings also offer opportunities to engage in cross-cultural

Table II. *Benefits and barriers to web-based trainings*

Benefits and barriers to web-based trainings		Users	Organizations
Benefits	Widespread reach	✓	✓
	Accessible at any time	✓	✓
	Flexible	✓	✓
	Individualized learning	✓	
	Low cost		✓
	No travel	✓	✓
	Cross-cultural learning	✓	
	Quick and easy changes		✓
	Consistent and standard message		✓
	Risk-free environment	✓	
	Simultaneous implementation	✓	✓
	Improved computer skills	✓	✓
Barriers	Interpersonal factors	✓	
	Time	✓	✓
	Cost	✓	✓
	Learner initiative	✓	
	Technical support	✓	✓
	Access/availability of computers/internet	✓	✓
	Isolation	✓	
	Technological skills	✓	✓
	Administrative support		✓

learning since they can be developed and implemented with input from users, trainers and experts worldwide [17, 18]. Organizations benefit from trainings since they can be implemented to all employees simultaneously with consistent messages. Changes to trainings can be made quickly and easily [13, 19, 20].

Barriers

While there are multiple benefits to be gained from web-based trainings, barriers exist for users taking part in the training and organizations developing them (Table II). The most significant obstacles from a user's perspective are those that are intrapersonal in nature: lack of skills and knowledge related to computer and Internet use, lack of learner initiative and physical disabilities [21–23]. Lack of time has also emerged as an obstacle for individuals, including personal and work time commitments and time required to learn how to use a new training

website [24–26]. Lack of access to up-to-date computers, the Internet and technical assistance is often cited as a significant problem for many users [17, 24, 27]. Users have also noted a lack of interaction with other participants as a barrier to web-based training courses [28, 29].

The most significant barrier for organizations is cost: both upfront in development and over time with maintenance [24, 30, 31]. Instituting a training website is labor intensive and many organizations have found they lack the time needed to design, develop, maintain, update, evaluate and support a web-based training [27, 32, 33]. A lack of technical skills on behalf of the trainers has been cited as a barrier, along with a lack of administrative support for development of the training. Organizations are often resistant to any changes in traditional training methods in order to adopt a web-based innovation [24, 30, 32].

Key components to promote/retain users throughout the duration web-based trainings

Through the literature review process, a number of key characteristics repeatedly emerged as important to the design and implementation of successful web-based trainings. Key characteristics were extracted individually by multiple reviewers and compared for accuracy. A list of eight recommendations was compiled to summarize these fundamental elements (Table III). This list of recommendations may be used as a planning tool to begin the process of identifying the most important elements needed for effective web-based trainings. Given the developmental state of the field, these should be considered along with other relevant components as needed.

Formative research

Formative research with the target audience is essential in developing and implementing web-based trainings to ensure acceptance and adoption. Conducting audience research with end users prior to the development process can assess computer literacy, baseline knowledge of the subject matter,

Table III. *Key recommendations to guide development, implementation and maintenance of web-based trainings*

Domain	Key elements
1. Formative research	1. Conduct needs assessment with users prior to web-based training development to assess computer literacy, baseline knowledge, learning needs, demographic information and technological capabilities.
	2. Assess organizational culture and incorporate organizational priorities into training development.
	3. Involve users in the development of web-based training components.
2. Design and layout	1. Include a clear and consistent organizational flow.
	2. Use clear, concise and consistent formatting throughout the training.
	3. Include clear and consistent hyperlinks.
	4. Provide visual appeal.
	5. Use appropriate multimedia (graphics, video clips, audio clips, animation).
	6. Create trainings that are compatible with multiple platforms (e.g. PC, Macintosh) and browsers (e.g. Explorer, Firefox).
	7. Provide flexibility in learning.
	8. Provide opportunities for users to learn from their mistakes.
3. Content	1. Use concise and relevant text.
	2. Provide training background information.
	3. Use concrete real-world examples.
	4. Provide links to websites that provide additional relevant information.
4. Interactivity	1. Provide features that allow users to interact with the training.
	2. Provide opportunities for users to communicate with each other and trainers.
5. Technical support	1. Provide technical support by incorporating at least one of the following: initial training to introduce users to web-based training format, automated help desks, toll-free hotlines, 24/7 service, remote online troubleshooting, frequently asked questions.
User feedback and follow-up	
6. Feedback and follow-up	1. Provide users with meaningful feedback throughout the training.
	2. Allow users to provide feedback about the training.
Promoting web-based training	
7. Marketing and promotion	1. Market web-based trainings to the public through: links placed on frequently used websites, peer testimonial, search engine optimizers.
	2. Market web-based trainings within an organization through: newsletters, flyers, brochures, e-mails, staff meetings, demonstration workshops.
8. Incentives	1. Provide certificates for completion.
	2. Provide rewards or recognition for completion (e.g. newsletters, memos, bulletin boards, e-mails).

learning needs and expectations, learning style, demographic information and technological capabilities [14, 34, 35]. Assessing organizational culture and incorporating organizational priorities into the training development helps create a training that is supported and encouraged by company leaders [35–37]. Involving intended users in the development of web-based training components increases the likelihood that the content matches the needs of their job practices and creates buy-in [38].

Design and layout

A major factor influencing retention of users is the site's design and layout. A strong web-based training design should include a clear and consistent organizational flow [39–41] with the home page serving as a table of contents, allowing users to quickly reach the training areas of interest to them. Navigation should be clear and simple, so users can move back and forth through modules easily and with minimal clicks.

Clear, concise and consistent formatting should be used throughout the web-based training [41–43]. It is important for the layout of the site to be consistent from page to page, with the training name and logo present on each page. A navigation bar, including a link to the home page and a link to different modules within the training, and a search function should be present on each page with a fixed position and consistent appearance [34, 44, 45]. Organization of information on the training web pages must be clear, including headings on each page that have a consistent look and logically grouped training topics that help orient users. The site should also be designed to be accessible for disabled users (e.g. visually impaired, hearing-impaired) [43].

Providing visual appeal is an aspect of design and layout that is relatively simple, yet significantly important to keeping users at a web-based training [28, 29, 46]. The use of color, graphics, video clips, audio clips and animation adds to the visual appeal by gaining the attention of users and increasing their engagement with the training [45, 47, 48]. However, the use of graphics and multimedia should be appropriate for the training topic, balanced with the content, and informational as opposed to decorative [34, 44].

Hyperlinks used throughout the training to link users to additional information regarding the content should be clearly identified with a standardized format that is descriptive, unambiguous and does not include distracting graphics [41, 46, 48]. Other design considerations incorporate technology that is compatible and supported by multiple platforms (e.g. Macintosh, Windows) and Internet browsers (e.g. Explorer, Firefox, Safari) [28, 41, 48].

Successful web-based training designs support independent learning by allowing users to make choices about the exercises in which to engage, the nature of feedback received, the order of module completion, the nature of the examples and the topics chosen. Allowing flexibility in learning is key to retaining web-based users [24, 28, 41]. It is necessary for modules to accommodate differences in learning styles by using various instructional elements (e.g. case studies, story-telling, demonstrations) [49] as well as providing opportunities for

users to learn from their mistakes [49, 50]. Moreover, web-based trainings should be designed so users can take them at times when there is little disruption to their work.

Content

Concise and relevant training course content is critical [41, 44, 51]. When viewing web pages, short phrases and bullets are most effective, and sentence and paragraph length should be limited. It is important to avoid professional terminology or jargon, clarify terms when needed, and develop content at an appropriate reading level for the intended users [19, 43, 52]. To minimize disruption of normal work responsibilities, trainings should utilize short modules (2–4 hours). Content should be evidence-based, relevant to the user's job tasks, up-to-date, comprehensive, culturally sensitive and free of errors. To facilitate development of relevant and timely content, course developers should consult real-world experts and practitioners to help develop content [49].

Concrete 'real-world' examples are often part of successful web-based trainings, [20, 41, 49] along with stories and goal-based scenarios, which emphasize skill building and application rather than rote memorization of instructional material. Real-world examples can also be included by providing links to other industry-related sites where users can find additional information [28, 48, 53].

Interactivity

One of the most critical elements in developing web-based trainings to attract and retain users is interactivity. Web-based trainings should provide features that allow users to interact with the training in a meaningful way [13, 29, 49], including interactive quizzes that give automatic feedback, games that practice training topics, realistic simulations, role-playing opportunities, opportunities to work in teams, learn from mistakes, communicate with each other and communicate with the course trainer [13, 29, 54]. Chat rooms, instant messaging, bulletin boards, blogs, e-mail, audio and video conferencing and online learning coaches can facilitate these types of communications.

Technical support

Web-based trainings require technical support to update content and troubleshoot issues as they arise. Ensuring timely and up-to-date content is important to maintaining use of a web-based training over time, as users are more likely to complete trainings that offer new information and correspond to the changing environment in which they work [28, 40, 41]. Technical support is critical to maintaining a web-based training that is available and functional for all users [24, 28, 55]. For web-based trainings that are always accessible, technical support should be offered 24 hours a day, 7 days a week. Support may be offered through toll-free hotlines, automated help desks, remote online troubleshooting, computer bulletin board systems and frequently asked questions pages. In order to provide users with an adequate introduction to the web-based training format, trainings can include either a virtual learning tutorial or initial face-to-face orientation [21, 25, 56].

Feedback and follow-up

Providing feedback and follow-up to users is instrumental in facilitating long-term engagement with a web-based training [14, 50, 57]. Users benefit most when feedback from quizzes, assignments and practice exercises is provided in a timely manner. Feedback is meaningful when it summarizes individual performance throughout the training experience, reinforces learning and highlights areas in which the user is now competent [15, 58, 59]. Users should also be encouraged to provide feedback to the trainer and evaluate the course and experience [41, 51, 59, 60]. Along with feedback, follow-up and communication between the user and trainer should be promoted and encouraged to maintain engagement throughout the duration of the training [40, 29, 61].

Marketing and promotion (external and internal)

Marketing web-based training is needed to ensure strong participation by targeted users. Different strategies should be utilized when marketing to the public as opposed to within an organization. Organizations promoting web-based trainings to the public should consider placing a link to the website on homepages that are visited often by intended users [41, 19]. One strategy important for reaching and introducing a large number of people to a new website is ensuring that search engines (e.g. Google, Yahoo) can locate the website when users perform a search query. This process, called search engine optimization, increases the volume and quality of traffic to the website by making it more visible to users [39, 51, 62].

Several inexpensive and effective ways to reach a large number of users within an organization include newsletters, flyers, brochures, e-mails and the company Intranet [39, 63, 64]. Promotion techniques such as integrating web-based training into new employee development or orientations [38, 65] encouraging organizations/managers to recommend the training [19, 66] or mandating the training [65, 67] help to ensure employees are trained appropriately. Workshops and demonstrations on how to use the training website have been effectively used by organizations [41, 52]. While policies can be set in place to ensure that employees receive the required training, it is worthwhile to showcase the successes and benefits that can be achieved through participation in the training [64, 67]. This encourages voluntary participation as opposed to mandatory participation.

Incentives

Incentives have been found to be useful in recruiting and retaining users for web-based trainings [15, 41, 68]. Certificates can be presented at the completion of the training and placed in employee personnel files. Likewise, employees are often recognized through internal newsletters, memos to the company, announcements on bulletin boards and e-mail messages. Access to post-training resources such as citations of scientific literature, lists of websites for additional information and other downloadable materials to further reinforce training concepts can be offered [69].

Recommended criteria for evaluating web-based effectiveness

The literature on evaluation methods and measures for web-based training is limited. Due largely to the cost of designing and conducting trainings, few organizations invest the time and finances into evaluating them for learning outcomes and achievements. As a result, little is known about what criteria best measure the key characteristics and effectiveness of web-based trainings. Some research and practice-based resources have established criteria to generally evaluate web-based trainings. These can be classified into two main categories: (i) criteria to evaluate training effectiveness and (ii) criteria to evaluate training design and functionality. Table IV summarizes the key criteria often used to evaluate web-based training effectiveness.

Table IV. *Recommended criteria for evaluating web-based training effectiveness*

Evaluating web-based trainings	Recommended criteria
Effectiveness	User reaction
	User knowledge
	User attitudes
	User behavior change
	Organizational change
Design and functionality	Content
	Design
	Accessibility
	Usability
	Resource availability
	Technology

Discussion

We conducted this review of the web training literature to summarize the lessons learned across multiple disciplines. These lessons are being applied in a web-based training for public health practitioners to control cancer. What we learned can also contribute to the broader context of public health workforce training, or any field that is interested in exploring the use of a web-based training venue as an alternative to traditional face-to-face methods.

While web-based learning offers potential benefits including unique interactive capabilities, it is important to note that many online courses simply replicate a lecture-based approach which may not be the most effective method. If we are going to make a paradigm shift to web-based learning, we should first revisit the basic principles of adult learning which emphasize 'learning by doing' rather than being lectured to, so that we do not build on the same flawed model of how people learn [49, 70]. We have an opportunity to build an enhanced training model that emphasizes learning by doing, learning from mistakes and learning from stories [49, 70, 71]. We are exploring the use of scenario-based learning which teaches important concepts within the context of authentic or real-world situations [49, 71]. Context gained via problem solving is thought to be more motivational to learners and it provides a concrete framework from which complex concepts can be more easily understood and most importantly applied [49]. If web-based trainings are engaging and relevant, learners are more likely to complete them, retain lessons and more importantly apply what they have learned back to their 'real-world' jobs.

While the literature review was comprehensive in looking at both research- and practice-based articles from multiple disciplines, it is important to note several limitations. The greatest limitation was the paucity of information from public health sources. In addition, the literature on evaluation methods and measures for web-based training was limited. Our review was limited by information that could be gathered from libraries, online databases and search engines, which precluded the researchers from combing the breadth and depth of information related to the topic. Despite these limitations, our study provides valuable insights. With the growth of the Internet, web-based training is a promising distribution channel for reaching large numbers of public health practitioners while saving time and costs. Therefore, to fully understand the implications of moving from a traditional, face-to-face delivery method to a virtual, web-based delivery method our literature review across five disciplines identified key components needed to develop and promote efficient web-based training programs.

Due to the transdisciplinary nature of the review, these recommendations should be further tested within the public health field to better understand the most effective methods for web-based training for this audience. It is important to note that 'one size will not fit all' as there is tremendous variability in the public health field [72].

There is no one web-based training design that will be effective for all audiences. The recommendations presented highlight key factors found to be successful in web-based trainings; however, it is critically important to understand the needs of the specific 'real-world' target audiences [72] and learn about the barriers that exist, in order to incorporate the training content and design elements that will create the most effective learning environment [69]. Tailoring curriculum may increase relevance and to meet the needs of multiple groups. Audience research including learning about learner context and capacity [72] and targeting trainings to address organizational dynamics and 'real-world' constraints (e.g. agency turn over, variations in educational background) will be critical to success [72].

We have made a case for the potential efficiency of web-based trainings and the need for this efficiency in the current economic climate. Web-based training is a promising channel for reaching a large number of public health practitioners in a time when resources are decreasing and travel restrictions are increasing; however those who have expertise regarding content may not have the time, expertise or resources needed to translate content to web-based technology. Initially, translating content may be costly and requires specific expertise, but the potential to save costs in the long run shows promise.

The remaining big-picture question is whether web-based trainings are as effective as more traditional training methods. We do not yet have the answer to this question yet, but it is critically important. An approach for understanding effectiveness is to compare web-based training with traditional face-to-face trainings. There is also a need to document the costs associated with the development, implementation and maintenance of web-based trainings.

From our study several other important topics for further study emerged:

- Greater understanding of what motivates people to access and use web-based training venues.
- The need for measures (both individual and organizational level) to determine the effectiveness of web-based training methods.
- The need to conduct more consistent and systematic evaluations as new web-based training programs are developed.
- The need to compare the effectiveness of separate and combined face-to-face public health trainings with web-based trainings.
- Greater understanding of the factors that support or inhibit web-based training. If these can be better characterized, we can better identify the pathways that are most promising to the uptake of web-based training methods.
- Establishing marketing and distribution infrastructure to disseminate web-based trainings in public health [73]. It is important that the appropriate leaders are on board early in the development process to guide marketing and distribution efforts.

Perhaps web-based technology will be a key method for training our public health workforce in this ever-changing environment of a continued push to do more with less. We have an opportunity to reinvent the traditional face-to-face training method to take advantage of web-based methods which may actually enhance public health training efforts.

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