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Quality Evaluation Tool for Clinician Online Continuing Medical Education

Brittany Rosen
University of Cincinnati, brittany.rosen@cchmc.org

Gary Kreps
George Mason University, gkreps@gmu.edu

James M. Bishop Mr.
University of Cincinnati, bishojs@mail.uc.edu

See next page for additional authors

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Quality Evaluation Tool for Clinician Online Continuing Medical Education

Abstract

The purpose of this study was to develop and assess an instrument evaluating the quality of online continuing medical education interventions for clinicians. A review of seminal literature for evaluating health-related websites was conducted to incorporate best practices from health education, health communication, and web-based design principles. After reviewing the literature, 12 preliminary quality indicators were developed. Two independent coders used the preliminary quality indicators to code continuing medical education interventions. Internal reliability of the preliminary indicators was calculated using the Krippendorff's alpha coefficient. After completing the reliability testing and revising the tool, the quality evaluation framework consisted of six quality indicators: accessibility, content, design, evaluation, interactivity, and theory/models. The indicators are not specifically tied to one content area; therefore, this tool can be utilized to assess the quality of continuing medical education interventions of various content areas. Future research should be conducted to further develop a comprehensive metric to assess indicators' effect on behavior change and clinician communication with patients. These quality indicators are important as they are a foundation for intervention developers to effectively communicate current medical information and new guidelines from medical organizations and, in turn, impact patient communication and care.

Keywords

Evaluation, Continuing Medical Education, Communication, Health Personnel

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Authors

Brittany Rosen, Gary Kreps, James M. Bishop Mr., and Skye L. McDonald

Quality Evaluation Tool for Clinician Online Continuing Medical Education

Brittany L Rosen, PhD, MEd, CHES®, FASHA*
Gary L Kreps, PhD
James M Bishop, M.Ed., CHES®
Skye L McDonald, MS, CHES®

Abstract

The purpose of this study was to develop and assess an instrument evaluating the quality of online continuing medical education interventions for clinicians. A review of seminal literature for evaluating health-related websites was conducted to incorporate best practices from health education, health communication, and web-based design principles. After reviewing the literature, 12 preliminary quality indicators were developed. Two independent coders used the preliminary quality indicators to code continuing medical education interventions. Internal reliability of the preliminary indicators was calculated using the Krippendorff's alpha coefficient. After completing the reliability testing and revising the tool, the quality evaluation framework consisted of six quality indicators: accessibility, content, design, evaluation, interactivity, and theory/models. The indicators are not specifically tied to one content area; therefore, this tool can be utilized to assess the quality of continuing medical education interventions of various content areas. Future research should be conducted to further develop a comprehensive metric to assess indicators' effect on behavior change and clinician communication with patients. These quality indicators are important as they are a foundation for intervention developers to effectively communicate current medical information and new guidelines from medical organizations and, in turn, impact patient communication and care.

*Corresponding author can be reached at: brittany.rosen@cchmc.org

Introduction

Internet use has steadily increased over time since its inception (Pew Research Center, 2018). Widely available in developed countries (Internet World Stats, 2019), the Internet has the potential to provide a vast amount of information presented in an accessible and comprehensive format allowing patients and medical professionals to rapidly search for and gather relevant health information. Current estimates indicate nearly 90% of adults in the United States regularly access the Internet for information (Accreditation Council for Continuing Medical Education, 2017; Pew Research Center, 2018), with an estimates suggesting between 70% to 80% of adults look for health information online (Fox, 2011; National Cancer Institute, 2018). The Internet, and eHealth programs—healthcare supported by technology and electronic processes—have the potential to: a) improve health outcomes by increasing reach, accessibility, and effectiveness of health education programs (Bennett & Glasgow, 2009), while also b) limiting program costs (Tate, Finkelstein, Khavjou, & Gustafson, 2009).

An indication of Internet health education program importance is highlighted in Healthy People 2020. The Healthy People 2020 health communication goal focuses on utilizing health communication strategies and health information technology to increase positive health and healthcare outcomes and equality as well as to attain health equity (Office of Disease Prevention

and Health Promotion, 2018). This goal recognizes the potential for Internet health information programs to improve health care quality and safety, improve the public health information infrastructure, facilitate clinical and consumer decision-making, and build health skills and knowledge (Office of Disease Prevention and Health Promotion, 2018). With specific objectives aiming to increase individuals' access to the Internet and increase the proportion of quality, health-related websites emphasizing the importance and critical need of Internet health programs, web-based interventions are a promising method to deliver health interventions (Olivieri, Knoll, & Arn, 2009). In addition, the current Healthy People 2030 framework aims to support the implementation of evidence-based programs that are replicable, scalable, and sustainable (US Department of Health and Human Services, 2019). Multiple systematic reviews and meta-analyses indicate online interventions are effective in aiding smoking cessation (McCrabb et al., 2019), changing behavior in teenage and young adult cancer survivors (Pugh et al., 2016), supporting self-management in HIV (Cooper, Clatworthy, Whetham, & Consortium, 2017), and positively influencing sexual health behaviors including sexual health knowledge, safe sex, self-efficacy, safer-sex intentions, and sexual behavior (Bailey et al., 2010).

Online interventions are a low-cost option to quickly update and address health education topics (Olivieri et al., 2009) and as such have become a popular delivery method for healthcare professionals to obtain continuing medical education (CME; Cook et al., 2010), which should aim to provide clinicians with activities and educational interventions designed to change competence, performance, or patient outcomes (Accreditation Council for Continuing Medical Education, 2019). Furthermore, 42 out of 51 states'/territories' licensing boards require completion of 16 to 150 CME hours annually, biennially, or triennially (Federation of State Medical Boards, 2018). However, with the rapid development of web-based CME interventions, fundamental health communication and education design principles are potentially disregarded limiting program quality and efficacy, such as lack of impact on clinicians' knowledge and practice and limited improvement in quality patient care (Goldberg & McKhann, 2000; Harris, Novalis-Marine, & Harris, 2003; Shaw, Barnet, Mcgregor, & Avery, 2015). Therefore, public health and medical officials are potentially unaware of whether these web-based interventions and programs are achieving their intended outcomes, and which components need revisions and improvements (Kreps, 2002; Kreps, 2012).

Evaluation is an essential component of developing effective health education interventions (Kreps, 2002; Kreps, 2014), including: a) guiding efforts promoting clinician recommendations (Kreps, 2011; Kreps, 2012); b) understanding clinicians' educational needs, and c) assessing intervention outcomes (Neuhauser & Kreps, 2014). Using established health communication and education design principles to evaluate online interventions can: a) determine if interventions are worth the time and resources for continued implementation; b) identify strengths and weaknesses of interventions; c) provide evidence for designing effective interventions; d) provide insights on unintended consequences of the interventions (Cho & Salmon, 2007; Ringold, 2002); and e) ensure interventions address a populations' distinct educational and training needs, culture, and expectations (Harris et al., 2003). Therefore, the purpose of this study was to develop and assess an instrument evaluating the quality of online CME interventions for clinicians.

Phase I: Reviewing Existing Literature and Selecting Criteria

To develop a quality evaluation tool to assess the features of health service providers' online CME, we conducted a review of seminal literature for evaluating health-related websites (Cummins et al., 2003; Evers et al., 2003; Eysenbach & Köhler, 2002; Kim, Eng, Deering, & Maxfield, 1999; Yen & Bakken, 2012). These articles were identified through the following methods: 1) search via Google Scholar with key words for online and web-based educational evaluations; 2) evaluation of the articles by health communications experts; and 3) citation analysis (analyzing citations from identified articles and how often they are cited within the identified articles). To identify key indicators and duplication, information of criteria from the published literature were entered into a matrix. There were originally 58 indicators representing concepts ranging from "ownership" to "evaluation" to "design efficiency." Because criteria used several specific sub-criteria to describe a concept, the wording and terms varied between the same or similar concepts within the published articles. Due to variations in concept terms but similar definitions, the project team reviewed the 58 indicators for definition redundancies. Definitions considered to be the same or similar were deemed to be redundant and were consolidated. For example, the "links" indicator was defined as quality of links, and links to other sources in one article (Kim et al., 1999), and described as "outbound links" with the definition of, "if a trustworthy site provides links to other sites, they [the links] are trustworthy as well" in a different article (Eysenbach & Köhler, 2002). After redundancies were reviewed and consolidated, the indicators that were repeated at least twice within the various published articles were selected to be included in the quality evaluation tool.

Phase II: Developing Criteria

After reviewing the literature, the following indicators were created: 1) accessibility, 2) accountability, 3) audience, 4) authority of source, 5) commercial products sold, 6) content, 7) design, 8) evaluation, 9) interactivity, 10) links, 11) privacy and confidentiality, and 12) theory/models. Table 1 provides the 12 initial indicators and 47 sub-indicators. Once indicators and sub-indicators were created, the behavioral health and health communication expert team collected quantitative data regarding the number of times each indicator was presented within the seminal articles. The top six indicators were selected for inclusion, and included accessibility, content, design, evaluation, interactivity, and theory/models. The goal was to focus on the quality of online interventions by incorporating best practices from health education, health communication, and web-based design principles.

Accessibility initially had two sub-indicators assessing the cost of the module, and whether registration was required to access the module; however, the project team included an additional sub-indicator to examine whether there was a cost for CME credits. When creating indicators and sub-indicators, *content* focused on the interventions' purpose statement, provided date of updated information, presentation of clear references, links to other resources, reliability of references/sources, statement indicating content was developed by expert, and disclosure statements. The project team determined *links* (links to other sources) could be included in *content*. Additionally, the health education and communication team experts determined *authority of source* sub-indicators could be included as sub-indicators in *content*. Information quality, reliability, accuracy, scope and depth were removed due to the tool's focus on evaluating quality of certified CME and maintenance of certification (MOC) interventions and modules for

Table 1

Indicators and Sub-indicators

Indicator	Sub-indicator
Accessibility	• Free or cost • Registration required
Accountability	• Someone/some place that users can direct their questions • Is the information easy to find?
Audience	• Audience is clearly indicated; who they are trying to target • What do they want their audience to do after the modules?
Authority of Source	• Disclosure of authors, sponsors, and developers • Identification of purpose • Identification of the nature of the organizations • Sources of support • Content developed by experts
Commercial Products	• Commercial products sold on the site • Is there a connection between behavior change content and commercial products sold on the site? • Sources and voice of the message/product
Content	• Information quality • Reliability • Accuracy • Scope • Depth • Frequency of updating information • Freshness of data • Presentation of clear references
Design	• Layout • Interactivity • Appeal • Graphics • Use of media

health service providers. *Design* assessed sub-indicators of layout through font and line spacing and graphics. The *interactivity* sub-indicator in *design* was already an indicator and was further developed as a stand-alone indicator. Use of media was assessed within the *content* indicator as reliable references and links to other sources. *Evaluation*, which initially started with four sub-indicators, was reduced to two sub-indicators for the purpose of the tool. The sub-indicators assessing whether there was a statement regarding how the program is evaluated for effectiveness, and what type of evaluation design is used were removed due to the tool's focus on quality of design principles. *Interactivity* sub-indicators were utilized as indicators for the module's interactive components, and *accountability* sub-indicators of a place to direct questions was included in *interactivity*. The last indicator was *theory/models*, and it was included as previous literature had proposed.

Table 1

Indicators and Sub-indicators (cont.)

Indicator	Sub-indicator

Evaluation	• Is there a statement regarding how the program is evaluated for effectiveness?
	• What type of evaluation design is used (e.g., randomized clinical control trials, cohort/observational studies, case reports)?
	• Which level of evaluation is used:
	  o Did users like the program?
	  o Did users' knowledge, skills, attributes improve?
	  o Did users change behavior?
	  o Did the program have any benefits?
	  o Did the benefits exceed the costs?
	• Are users given the opportunity to evaluate the program?

Interactivity	• Discussion boards • Ask the expert • Bulletin boards • Signing up for the email reminders and newsletters • Other
Links	• Links to other sources • Quality of links
Privacy and Confidentiality	• Password to enter site • Secure server • Cookie versus non-cookie version • Privacy policy statement • Privacy endorsement or seal from TRUSTe, HON, or HiEthics • Indication of how the information being collected will be used • Statement of security procedures in place to protect loss, misuse, or alteration of information (e.g., firewall, encryption, and secure databases)

Theory/Models	• Which behavior change variables does the site say that it is using?
	• Which behavior change theory/model does the site say that it is using:
	  o Transtheoritical Model?
	  o Stages of Change Model?
	  o Theory of Planned Behavior?
	  o Social Learning Theory?
	  o Health Belief Model?
	  o Other?

In developing the criteria for this quality evaluation instrument focused on health service providers, the project team decided to remove the indicators of *commercial products sold* as well as *privacy and confidentiality*. These indicators did not fit the purpose for this tool as web-based modules and interventions with CME and MOC are overseen by the Accreditation Council for Continuing Medical Education (Accreditation Council for Continuing Medical Education, 2017).

Furthermore, *audience* was also removed due to the focus on CME and MOC web-based interventions and modules which already targeted health service providers.

Phase III: Reliability Testing

Once face validity was assessed, through health and communication experts reviewing and analyzing the indicators for criteria, internal reliability of the sub-indicators was calculated using the Krippendorff's alpha (K-alpha) coefficient (De Swert, 2012). This coefficient provides information on the reliability of variables by counting pairs of scale points assigned by coders, treating coders as freely volatile, and delivering robust calculations not impacted by sample size, multiple coders, or missing data (Hayes & Krippendorff, 2007). Two independent coders (two of the authors) used the first draft of the tool to code a sample of CME interventions focused on HPV and HPV vaccination (further details about how these interventions were selected can be found at (Rosen, Bishop, McDonald, Kahn, & Kreps, 2018). Thirteen of the twenty-three sub-indicators were considered internally reliable with K-alpha coefficients > 90%. Ten of the sub-indicators scored between 50%-75%; these sub-indicators were reviewed for discrepancies between the two independent coders and were revised to account for the discrepancies. Two sub-indicators were considered to be irrelevant after the first round of coding and were removed from the tool (e.g., evaluation sub-indicator, "Statement on how the program is evaluated for effectiveness"). After the tool was revised, the two independent coders conducted another round of coding with an additional sample of interventions (Rosen et al., 2018). After calculating K-alpha coefficients for the second round of coding, the evaluation tool was considered to be internally reliable given all indicator scores were above .80, which is considered the norm for acceptable reliability (De Swert, 2012).

Phase IV: Final Review Criteria

After completing the reliability testing and revising the tool, the quality evaluation framework consisted of six key indicators: accessibility, content, design, evaluation, interactivity, and theory/models (Cummins et al., 2003; Evers et al., 2003; Kim et al., 1999; Yen & Bakken, 2012). Each key indicator was scored using various sub-indicators and higher scores for the indicators designated higher quality interventions. Table 2 provides the final quality evaluation tool along with coding for the tool. Coding options were developed to designate quantitative evaluation of the indicators (such as, yes/no and scales from 0-3). However, six sub-indicators ("cost to access," "cost for CME credits," "Date information was updated," "Reliable references/sources," "Included interactive component," and "Theory/model was used to develop") required qualitative information. For example, to determine whether a reference or source was reliable, qualitative coding included the following responses: Centers for Disease Control and Prevention, National Institutes of Health, state health departments, published peer-reviewed literature, and other (list).

Accessibility. Three sub-indicators were used to examine the target populations' access to the educational interventions (Evers et al., 2003; Kim et al., 1999). These sub-indicators included whether registration was required to access the intervention (score ranging between 0-1), cost to access the intervention (score ranging from 0-1), and cost for CME (score ranging from 0-1).

Content. Content was evaluated using seven sub-indicators (Cummins et al., 2003; Kim et al., 1999): identification of purpose (score ranging from 0-1); date the information was updated (score ranging from 0-1; if a date is provided, then the date is recorded); presentation of clear references with a minimum of at least one reference on at least one slide/one page (score ranging from 0-1); and links to other sources with a minimum of at least two links (score ranging from 0-1). Additionally, reliable references/sources with a minimum of at least one reference on at least one slide/one page (score ranging from 0-1) were assessed. If at least one reference appeared on at least one slide/one page, the source is recorded. Sources include Centers for Disease Control and Prevention, National Institutes of Health, state health departments, published peer-reviewed literature, and other (specify). Another sub-indicator assessed whether there was a statement indicating content was developed and/or reviewed by experts (score ranging from 0-1). The last sub-indicator examined whether there was a statement of disclosure of authors, sponsors, or developers with methods for disclosure including verbal at beginning of the presentation, text within a slide at the beginning of the presentation, or website text/statement (score ranging from 0-1).

Design. Layout and graphics were the sub-indicators measuring the design of the interventions (Kim et al., 1999). The layout of the intervention was assessed by examining whether: a) font style was easy to read (score ranging from 0-1); b) font size was easy to read (score ranging from 0-1); c) text color and page color contrast were easy to read (score ranging from 0-1); and d) line spacing was easy to read (score ranging from 0-1). Graphics were assessed to determine whether they were clearly labeled with a title representing the data within the graphic. Scores for this assessment ranged from 0 to 3 with 0 designating 0% of graphics were labeled, 1 designating a minimum of 25% of the graphics were labeled, 2 designating a minimum of 50% of the graphics were labeled, and 3 designating a minimum of 75% of the graphics were labeled.

Evaluation. Evaluation was assessed using three sub-indicators (Cummins et al., 2003; Evers et al., 2003; Kim et al., 1999). The first sub-indicator assessed whether participant outcomes were evaluated (e.g., knowledge and attitudes; score ranging from 0-1). The second sub-indicator examined the level of evaluation with scores ranging from 0- 2 with 0 designating no evaluation, 1 designating an evaluation of knowledge, and 2 designating an evaluation of attitudes. The final sub-indicator evaluated whether the participant was provided an opportunity to evaluate the intervention (score ranging from 0-1).

Interactivity. The indicator for interactivity was evaluated using two sub-indicators (Cummins et al., 2003; Evers et al., 2003): whether there was a location for participants to direct questions during the educational intervention (score ranging from 0-1), and whether the intervention included any interactive components (score ranging from 0-1). For both of these sub-indicators, if the intervention was a recorded webinar that does not provide contact information or an interactive component within the webinar, the sub-indicators were recorded as 0. Activities for the interactive component include discussion boards, “ask the expert,” bulletin boards, signup for email reminders, signup for newsletters, and other interactive components.

Table 2

Final Indicators and Coding for Quality Evaluation Tool for Health Service Provider Online Continuing Medical Education

		Coding		
Indicator	Sub-Indicator	Yes	No	Qualitative Information
Accessibility				
	Registration required	1	0	
	Cost to access	0	1	• Cost for population
	Cost for CME credits	0	1	• Cost of CME credits
Content				
	Date information was updated	1	0	• Date of information updated
	Identification of purpose	1	0	
	Presentation of clear references with a minimum of at least one reference on at least one slide/one page	1	0	
	Minimum of at least two links to other sources	1	0	
	Reliable references/sources with a minimum of at least one reference on at least one slide/page	1	0	• Centers for Disease Control and Prevention • National Institutes of Health • State health departments • Published peer-reviewed literature • Other (list)
	Statement indicating content was developed and/or reviewed by experts	1	0	• Expert credential(s) • Expert affiliation(s)
	Disclosure of authors, sponsors, or developers (methods for disclosure: verbal at beginning of presentation, in presentation slide, or website text/statement)	1	0	
Design				
	Font style was easy to read	1	0	
	Font size was easy to read	1	0	
	Font color and page color contrast was easy to read	1	0	
	Line spacing was easy to read	1	0	
	Graphics were clearly labeled (representation of data had title)	0 = 0% are labeled[a] 1 = minimum of 25% of graphics are labeled 2 = minimum of 50% of graphics are labeled 3 = minimum of 75% of graphics are labeled		

Table 2

Final Indicators and Coding for Quality Evaluation Tool for Health Service Provider Online Continuing Medical Education (cont.)

		Coding		
Indicator	Sub-Indicator	Yes	No	Qualitative Information
Evaluation				
	Evaluation for participant outcomes	1	0	
	Level of evaluation[b]	0 = No level of evaluation[a] 1 = evaluation of knowledge 2 = evaluation of attitudes		
	Participant provided opportunity to evaluate online CME	1	0	
Interactivity				
	Location to direct participant questions	1	0	
	Included interactive component	1	0	• a = Discussion boards[b] • b = "Ask the expert" • c = Bulletin board • d = Signup for email reminders • e = Signup for newsletter • f = Other (list)
Theory/Models				
	Theory/models used to develop online CME	1	0	• a = Health Belief Model[b] • b = Theory of Planned Behavior • c = Transtheoretical Model • d= Precaution Adoption Process Model • e = Social network • f = Diffusion of Innovations • g = Social Cognitive Theory • h = Ecological • i = Other (list)

CME = continuing medical education

[a] indicates sub-indicators not coded with "Yes/No" options

[b] indicates more than one response option can be selected

Theory/Models. The theory/models indicator was evaluated by examining whether there was an explicit statement that a theory or model was used to develop the intervention (score ranging from 0-1; Cummins et al., 2003; Evers et al., 2003; Yen & Bakken, 2012). Theories/models listed in the evaluation tool included the Health Belief Model, Theory of Planned Behavior/Theory of Reasoned Action, Transtheoritcal Model, Precaution Adoption Process Model, social network theory, Diffusion of Innovations theory, Social Cognitive Theory, Ecological Model, and other theories (list). See Figure 1 for full quality evaluation tool.

Discussion

The purpose of this study was to design and assess an instrument evaluating the quality of online CME interventions for clinicians. After reviewing existing literature for evaluating health-service websites, an initial 12 indicators and 47 sub-indicators were identified. The list of indicators and sub-indicators was condensed based on relevance to design and education best-practice principles. Once reliability of the data was tested, the indicators were finalized into six areas: *accessibility, content, design, evaluation, interactivity*, and *theory/models*. This study produced a quality evaluation tool, supported by seminal literature, as a template to assess best practices in health communication and design quality in CME web-based interventions.

While reviewing literature and existing online CME interventions, a lack of health communication and design quality evaluation of web-based CME was identified and taken in to consideration when developing the evaluation tool. This poses a problem as health communication and design principles are important components to ensure online interventions have a higher likelihood of enhancing clinicians' perceptions, knowledge, attitudes, and practice behaviors (Allison et al., 2005; Carney, Dietrich, Freeman, & Mott, 1995; Casebeer et al., 2003; Fordis et al., 2005; Harris, Kutob, Surprenant, Maiuro, & Delate, 2002; Marinopoulos, US Agency for Healthcare Research and Quality, & Johns Hopkins University, 2007).

While there have not been many in-depth studies of online CME (Fordis et al., 2005; Tian, Atkinson, Portnoy, & Gold, 2007), several articles on web-based behavior change consisted of overlapping criteria that should be included in quality online interventions. These articles helped narrow down the list of quality indicators deemed most critical for quality health communication and design. Evaluating *accessibility* to CME interventions is critically important, as it is necessary to know the required steps clinicians must go through to complete the interventions. The requirement of registration and/or costs associated with accessing the intervention or for CME could impact or deter clinicians from accessing the education. An evaluation of the intervention's *content* is needed to ensure the intervention is up-to-date, credible, and providing appropriate sources for additional information. *Design* elements are vital to ensure that the intervention is visually appealing and that the font and graphics are clear and easy to read. In addition, a built-in *evaluation* for intervention effectiveness is an essential education and design component to determine the impact of the intervention on behavior change. *Interactivity* is another critical indicator with most program developers failing to include this vital educational component (Evers et al., 2003). Lastly, *theory/models* provide a foundation for interventions to build from to produce behavior change (Goodson, 2010). By creating a standard for the use of theoretical framework in an evaluation tool, CME developers might be more inclined to utilize theoretical framework when creating CME interventions.

The indicators and sub-indicators included in this evaluation tool provide a template for CME developers to utilize in developing quality online continuing education opportunities for

clinicians. Because the use of health communication and design quality principles have the potential to enhance clinicians' perceptions, knowledge, attitudes, and practice behaviors (Allison et al., 2005; Carney et al., 1995; Casebeer et al., 2003; Fordis et al., 2005; Harris et al., 2002; Marinopoulos et al., 2007), it is necessary that these components be included in designing and refining online continuing education programs to effectively and positively improve clinicians' practices. Without a guiding set of principles to follow when creating and revising online continuing education programs, it is nearly impossible to predict the outcome of the online interventions on clinicians' practice or determine whether interventions are accomplishing their objectives. The existence and use of a quality evaluation tool for online interventions aimed at CME for clinicians could increase confidence and cost-effectiveness in these interventions to meet minimum health communication and design principles to enhance clinicians' practices and communication with patients, as well as identify the strengths and weaknesses of online CME. While this tool does not provide assessment information on the unintended consequences or whether the learners' needs were met, the tool is a starting point to evaluate, at a minimum, cost-effectiveness, strengths, and weaknesses (Rosen et al., 2018). By shedding light on the absence of these principles and creating a tool to evaluate online interventions, a stronger push can be made for CME developers to utilize these principles to develop quality continuing education opportunities. In addition, data produced from this tool can be used to develop next steps for assessing unintended consequences including clinician practices and patient health status (Tian et al., 2007).While this study provides several strengths, limitations should be considered when applying results. First, this study consisted of a cross-sectional review of the literature at one point in time, and further research will be needed to determine the extent to which online sites are improving in key areas. Second, this study focused solely on evaluating the quality of the online CME and did not assess actual influences on clinician knowledge or behavior change. Third, this study was limited to two raters. While additional raters are usually preferred in reliability testing, we selected the K-alpha coefficient approach because of its ability to provide information on the reliability of variables, not coders. In addition, four of the *design* sub-indicators are dependent on subjective judgement (e.g., "easy to read"). Last, this tool was developed from the lens of evaluating HPV vaccine web-based interventions developed for clinicians and might have overlooked various components vital to other content areas. However, the research team attempted to create a generalizable tool for multiple CME content areas.

Implications for Health Behavior Research

The current study resulted in a quality evaluation tool for evaluating online CME interventions for clinicians. The evaluation tool consists of six indicators deemed most critical for quality health communication and design. These indicators are important because they can serve as a foundation for CME developers to ensure they are effectively communicating current medical information and new guidelines from medical organizations and institutions. Because the indicators are not specifically tied to one content area, this tool should be utilized to assess the quality of CME interventions of various content areas. Future research should be conducted to further develop a comprehensive metric to assess indicators' effect on behavior change and clinician practice.

Discussion Questions

1. Web-based educational interventions have started to emerge over the past 15 years due to their cost effectiveness and are likely to continue to grow. How are medical curriculum developers creating web-based educational sessions and what lessons can be applied to understanding the development of these web-based educational sessions? How can these methods be transformed to include evidence-based communication and design practices given the importance of quality health communication and design in creating effective educational sessions?
2. What are rigorous research methods to evaluate web-based educational sessions' impact on clinicians' behavior and practice? Are these convenient web-based educational sessions for continuing medical education effective or might they be causing only short-term behavior change or even unintended consequences?

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Appendix

Quality evaluation tool for clinician online continuing medical education

Q1 Is registration required to access the intervention?
- o No (0)
- o Yes (1)

Q2 Is there a cost to access the intervention?
- o Yes (0)
  - o $_____ cost to access
- o No/free of charge (1)

Q3 Is there a cost for Continuing Education (CEs)?
- o Yes (0)
  - o $_____ cost for CEs
- o No/free of charge (1)

Q4 Intervention provides purpose statement?
- o No (0)
- o Yes (1)

Q5 Intervention provides the date it was developed or presented?
- o No (0)
- o Yes (1)
  - o Date of information

Q6 Intervention presents clear references with a minimum of at least one reference on at least one slide/one page?
- o No (0)
- o Yes (1)

Q7 Intervention provides a minimum of at least two links to other sources?
- o No (0)
- o Yes (1)

Q8 Intervention provides reliable references/sources (i.e., minimum of at least one reference on at least one slide/page).
- o No (0)
- o Yes (1)
  - o Centers for Disease Control and Prevention (a)
  - o National Institutes of Health (b)
  - o State health departments (c)
  - o Published peer-reviewed literature (e)
  - o Other (f) _____

Q9 Intervention provides statement indicating content was developed and/or reviewed by experts.
- o No (0)
- o Yes (1)
  - o Expert credential(s)
  - o Expert affiliation(s)

Q10 Intervention provides a disclosure of authors, sponsors, or developers (methods for disclosure include: verbal at beginning of presentation, in presentation slide, or website text/statement).
- o No (0)
- o Yes (1)

Q11 Intervention font style was easy to read.
- o No (0)
- o Yes (1)

Q12 Intervention font size was easy to read.
- o No (0)
- o Yes (1)

Q13 Intervention font color and page color contrast were easy to read.
- o No (0)
- o Yes (1)

Q14 Intervention line spacing was easy to read.
- o No (0)
- o Yes (1)

Q15 Intervention graphics were clearly labeled (i.e., representation of data had title).
- o 0% are labeled (0)
- o Minimum of 25% of graphics are labeled (1)
- o Minimum of 50% of graphics are labeled (2)
- o Minimum of 75% of graphics are labeled (3)

Q16 Intervention provided an evaluation of participant outcomes (i.e., HPV/HPV vaccine knowledge, attitudes towards HPV and vaccine).
- o No (0)
- o Yes (1)

Q17 Level of evaluation in intervention (select all that apply).
- o No level of evaluation (0)
- o Evaluation of knowledge (1)
- o Evaluation of attitudes (2)

Q18 Intervention provides the participant an opportunity to provide feedback about the program.
- o No (0)
- o Yes (1)

Q19 Intervention provides location for participants to direct questions for current educational intervention status.
- o No (0)
- o Yes (1)

Q20 Intervention includes an interactive component.
- o No (0)
- o Yes (1; select all that apply))
  - o Discussion board (a)
  - o "Ask the expert" (b)
  - o Bulletin board (c)
  - o Sign up for email reminders (d)
  - o Sign up for newsletter (e)
  - o Other (f) _____

Q21 Intervention used a theory/model to develop online CE.
- o No (0)
- o Yes (1; select all that apply)
  - o Health Belief Model (a)
  - o Theory of Planned Behavior (b)
  - o Transtheoretical Model (c)
  - o Precaution Adoption Process Model (d)
  - o Social network (e)
  - o Diffusion of Innovations (f)
  - o Social Cognitive Theory (g)
  - o Ecological (h)
  - o Other(i) _____