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# The quality, breadth, and timeliness of content updating vary substantially for 10 online medical texts: an analytic survey

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## Abstract

**Objective:** To evaluate the quality of evidence reporting, breadth of coverage, and timeliness of content updating of 10 selected online medical texts.

**Study Design and Setting:** Each text was assessed for quality based on an 11-item scale, which included items related to editorial policy and updating, appraisal, and transparent incorporation of newly published clinical research and evidence-based guidelines. Breadth of coverage was determined by the percentage of 60 randomly selected International Classification of Diseases 10 (ICD-10) codes covered by each of the texts. The same 60 ICD-10 codes were used to obtain a sample of topic chapters for the assessment of timeliness of updates.

**Results:** Quality scores ranged from a high of 9 of 11 points (Clinical Evidence) to a low of 0 of 11 points (PEPID), with a mean score of 6.7. Breadth of coverage ranged from 83% of randomly selected topics covered (UpToDate) to 25% (Clinical Evidence), with 6 of 10 texts covering 60% or more; average coverage across all texts was 57%. Variability was also observed with regard to average time since last content update, ranging from 3.5 (DynaMed) to 29 months (First Consult), with an average time since update of 12.4 months.

**Conclusion:** No single resource was ideal and those seeking answers to clinical questions are well-advised not to rely solely on a single point-of-care product. 

*Keywords:* Evidence-based medicine; Evidence-based practice; Information science; Point-of-care systems; Online medical texts; Knowledge translation

## 1. Introduction

Online medical texts promise current, evidence-based recommendations for the management of medical problems at the point of patient care. Online medical texts are available globally. For example, texts such as UpToDate and Clinical Evidence each have hundreds of thousands of subscribers in 149 and 113 countries, respectively, and Clinical Evidence is free in 110 lower-income countries. These ''summaries'' of evidence-based practice ideally combine the clinical expertise of their authors with current and reliable interpretation of high-quality systematic reviews and pertinent original studies from the medical literature [1]. It has been recommended that medical professionals seeking evidence-based answers to clinical questions begin their search with resources at the summary level [1].

Numerous summary level resources exist and promote themselves as ''evidence based.'' Surveys show strong preferences among clinicians for evidence-based texts. For example, a recent cross-sectional survey in Canada found that, when looking to retrieve information on patient treatment, 91% of community-based nephrologists and 58% of academic nephrologists surveyed were more likely to consult UpToDate first [2].

Little research, however, has evaluated these texts and investigated whether using these texts improves process of care or patient outcomes. These are important issues not just for the clinicians and patients who need evidence-based care, but also for the librarians and administrators who need to decide where to spend scarce subscription dollars. If some texts are of higher quality than others, that may affect the process of care and patient outcomes. Such research may also provide valuable feedback to editors of evidence-based texts and enable them to improve their products. However, there are significant

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**What is new?**

- Ten online medical texts were evaluated for quality, breadth of topic coverage, and timeliness of content updating.
- The texts varied greatly in each of the categories studied. Although a few texts ranked highly across all categories, no single resource proved to be ideal.
- Clinicians should not rely on one resource when making important decisions. The use of federated search engines that allow clinicians to search multiple resources simultaneously should be considered when seeking evidence-informed recommendations for clinical care.
- Editors, authors, and publishers may use the results of this research to improve their products and build on their strengths.

methodological impediments to evaluating the effects of the use of these texts on process of care and patient outcomes. No research has yet investigated this issue.

Research on evidence-based texts has, to date, focused on issues of quality of preparation. Ketchum et al. [3]conducted a bibliometric analysis of references cited by five online texts (ACP PIER, Clinical Evidence, DynaMed, First Consult, and UpToDate). Variability was found for both the quantity and quality of references included in each of the products. For example, First Consult had the highest proportion of references that were of higher levels of evidence (systematic reviews, randomized controlled trials), but the lowest number of references. Ketchum et al. also found that the rate of citation overlap between the five point-of-care products was less than 1%. Banzi et al. [4] recently examined the breadth, content development, updating speed, and editorial policies of 18 point-of-care products. Their results showed room for improvement for many of these products.

Building on this recent work, we sought to evaluate 10 online medical texts, ACP PIER, Best Practice, Clinical Evidence, DynaMed, Essential Evidence PLUS, Medscape Reference (formerly eMedicine), First Consult, Micromedex, PEPID, and UpToDate. Our objective was to evaluate the selected online medical texts for quality of evidence reporting, breadth of coverage, and frequency of content updating (timeliness). Our study involved a different set of quality criteria than those used by others, and the added dimension of timeliness of updating. We did not examine whether clinicians translate the best evidence into practice, resulting in improved patient outcomes. However, given the pragmatic challenges of determining process of care and patient outcomes, our criteria serve as theory based and common sense surrogates for these outcomes. These challenges will be discussed further. We also anticipated that the results would be of value to medical professionals when deciding which resource to use, to aggregators and institutions when deciding which resources to provide to their users, and to editors, authors, and publishers, to improve their products.

## 2. Methods

### 2.1. Overview

Each of the selected 10 online texts was evaluated for quality of evidence reporting and breadth of coverage. Nine texts were evaluated for timeliness of updates, as one text did not provide the date of updates (PEPID). Assessments were made based on publicly available information on each of the texts' Web pages. Quality of evidence reporting was assessed using a previously developed measure (see Section 2.3). The methodology used for the assessment of breadth of coverage was based on previous work by Banzi et al. [4], whereas new methodology was developed for assessment of timeliness. After discussion and calibration of survey instruments, data were collected and evaluations were completed between March 3rd and 17th, 2011.

### 2.2. Selection of texts

Online texts were selected on the basis of availability (through McMaster University Health Sciences Library institutional access or free trial options) and having made claims of providing evidence-based information to medical professionals at the point of care (see Appendix A at www.jclinepi.com). Only English language services were evaluated. Analyses were restricted to the text-based core content of these services and did not include analyses of federated search functions and supplementary content. For example, Essential Evidence Plus searches and returns results from both the Essential Evidence summary text, and other resources including InfoPoems and Cochrane reviews. Our analysis only assessed the Essential Evidence summary text.

### 2.3. Quality assessment

The 11-point quality assessment scale (Table 1) was previously developed and validated by research staff at the Health Information Research Unit at McMaster University according to evidence-based principles [5] and has previously been applied to over 40 online texts (unpublished data). Each text was then reviewed independently by two research staff (J.C.P., E.C.I.). Each staff member assigned a "yes" (1) or "no" (0) score to each scale item for each of the evaluated texts. Scores were assigned based on publicly available information on each of the online text's Web pages. Whenever possible, disagreements were resolved by consensus. In a few instances, disagreements were resolved by an adjudicator (R.B.H.). Scale items were interpreted and scored by criteria as outlined in Appendix B at www.jclinepi.com

**Table 1.** Quality measure used to assess each of the selected 10 online texts

| Item | Score | |
|---|---|---|
| 1. ''In-line references'' for treatment recommendations | None<br>0 | Usually or always<br>1 |
| 2. ''In-line references'' for diagnostic recommendations | None<br>0 | Usually or always<br>1 |
| 3. Policy indicating steps to find new evidence | Absent<br>0 | Present<br>1 |
| 4. Policy indicating the rating of research evidence | Absent<br>0 | Present<br>1 |
| 5. Policy indicating the grading of recommendations | Absent<br>0 | Present<br>1 |
| 6. Date stamping of individual chapters | Absent<br>0 | Present<br>1 |
| 7. Indication of a schedule for updating chapters | Absent<br>0 | Present<br>1 |
| 8. ''New evidence'' tabs for individual chapters/topics | Absent<br>0 | Present<br>1 |
| 9. User alerts for new evidence according to user discipline | Absent<br>0 | Present<br>1 |
| 10. User alerts for new evidence according to individual topic | Absent<br>0 | Present<br>1 |
| 11. Federated search of content and external evidence source | Absent<br>0 | Present<br>1 |

### 2.4. Breadth of coverage

A consistent and reliable way to directly measure the topic coverage within each text could not be determined, as the texts are highly variable in their organization and presentation of information. To reliably estimate the breadth of topic coverage, we built on methods used by Banzi et al. [4]. Sixty International Classification of Diseases 10 (ICD-10) codes (excluding codes that were not medical conditions) were randomly selected through a randomization programming script. Two research staff (J.C.P., E.C.I.) independently entered each code name as a search term in each online text. If the first search did not return sufficient results, synonyms and alternate spellings were used to ensure a thorough topic search (see Appendix C at www.jclinepi.com).

Based on the returned search results, each of the two staff members assessed independently if the reportage of the code/topic was sufficient to be scored as ''covered.'' If a complete chapter existed on the specific code/condition, the topic was assessed as ''covered.'' If substantial information about the diagnosis and/or treatment of the code/condition was included within a chapter or chapters, the topic was also assessed as ''covered.'' If the code/condition was mentioned in a chapter, but without diagnosis and/or treatment information, or was not mentioned at all within the online text's database, the topic was assessed as ''not covered.'' Disagreements were resolved by consensus.

### 2.5. Timeliness of update

To assess the frequency of text updates, the same set of 60 ICD-10 codes was used to select a random sample of chapters from each text. One research staff member (E.C.I.) searched each code within the text and recorded the date of update for the first search result and the chapter title. Sixty unique chapters were used to obtain a random sample of date stamps. If the code did not return any search results, the research staff member entered synonyms and related terms until a usable search result was obtained. When multiple dates were present in a selected chapter, the date of the most recent editorial update was selected. The average date of update was calculated for each of the 60 ICD-10 codes within a text. The difference between the date of search and the average date of update was calculated for each of the 60 ICD-10 codes to calculate an estimated average time since last update. This was calculated for the nine texts that publish date stamps in each chapter to determine estimated timeliness of updates (PEPID did not include date stamps).

Essential Evidence Plus included date stamps within the chapter titles, making it convenient to validate the method used for assessing timeliness of updates. A research staff member (E.C.I.) copied the titles and dates of all 717 chapters within the Essential Evidence Plus database, eliminated duplicate title listings, and calculated the actual average date of last update for the service. The true date of last update was compared with our estimated average date of last update.

## 3. Results

### 3.1. Quality assessment

The two research staff agreed on their assessments of the presence/absence of each quality scale item 91% of the time; $k = 0.82$ (95% confidence interval [CI]: 0.63, 1.00) (Table 2). Disagreements, in most cases, were the result of one of the two staff members not locating the specific information within the online texts' Web sites, particularly regarding editorial policies. These types of disagreements were therefore resolved through discussion and further review of the available online text information.

The highest quality score assigned was 9 of a possible 11 points (Clinical Evidence), whereas the lowest score assigned was 0 (PEPID). Five texts (UpToDate, DynaMed, Essential Evidence Plus, Micromedex, and First Consult) received scores of 8 of 11 points. These texts were followed by Best Practice and ACP PIER, with scores of 7 of 11, and Medscape Reference with a score of 4 of 11. The average quality score was 6.7.

### 3.2. Breadth of coverage

Breadth of coverage was reviewed by two research staff (J.C.P., E.C.I.), who agreed on the assessment of presence/absence of topic coverage 95% of the time; $k = 0.89$ (95% CI: 0.81, 0.97) (Fig. 1; see Appendix D at www.jclinepi.com). Disagreements were again the result of one of the two reviewers not locating coverage of the specific code,

**Table 2.** Quality assessment scores for each of the 10 selected online texts

| Item | Clinical Evidence | DynaMed | Essential Evidence Plus | First Consult | Micromedex | UpToDate | ACP PIER | Best Practice | Medscape Reference | PEPID |
|---|---|---|---|---|---|---|---|---|---|---|
| "In-line references" for treatment recommendations | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| "In-line references" for diagnostic recommendations | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| Policy indicating steps to find new evidence | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Policy indicating the rating of research evidence | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Policy indicating the grading of recommendations | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Date stamping of individual chapters | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| Indication of a schedule for updating chapters | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| "New evidence" tabs for individual chapters/ topics | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| User alerts for new evidence according to user discipline | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| User alerts for new evidence according to individual topic | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Federated search of content and external evidence source | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| Total score | 9 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 4 | 0 |

as coverage of the specific code may have been located within a larger chapter. These disagreements were resolved through further review and searching of the texts to arrive at consensus. The percentage of topics covered ranged from a high of 83% (UpToDate), followed closely by Medscape Reference (82%), to a low of 25% (Clinical Evidence). Most of the texts had 60% coverage or greater. The average breadth of coverage across all texts was 57%.

### 3.3. Timeliness of updates see

Average time since update ranged from 106 days (3.5 months) for DynaMed, to 888 days (29 months) since update for First Consult (Fig. 2, Appendix E at www.jclinepi.com). Six of nine texts had an average time since last update within the past 12 months. The average time since last update across all texts was 12.4 months. PEPID did not provide date stamps within chapters; therefore, timeliness of updates could not be determined.

As previously indicated, the methodology for assessing timeliness of updates was validated with Essential Evidence Plus by calculating the actual average date of last update. Seven hundred seventeen unique chapter titles were identified with 715 associated dates (two chapters were undated). The 715 dates were averaged to calculate the true average time since update. This was completed on March 11, 2011 and resulted in an average time since update of 499 days (16.4 months). The estimated time since update using the 60 ICD-10 code method was 456 days (15 months), with a 95% confidence interval of 417–503 days. This encompasses the actual average date, suggesting this method is valid for estimating timeliness of updates.

### 3.4. Overall scores

Quality and breadth scores were not significantly correlated with one another ($r = -0.26$; 95% CI: −0.44, 0.76) (Table 3). Similarly, quality and timeliness ($r = -0.20$; 95% CI: −0.54, 0.76) and timeliness and breadth ($r = 0.21$; 95% CI: −0.53, 0.77) were not significantly correlated with one another. Thus, the three measures appear to provide complementary information.

Each text was rank ordered within each measure. The rankings were summed, giving an equal weight to each score. These were then ordered from lowest (best ranking) to highest (worst ranking) (Table 3).

## 4. Discussion

It is clear from this assessment that there is a great deal of variability among the examined texts in the three evaluated areas. None of the 10 selected online texts scored highest in

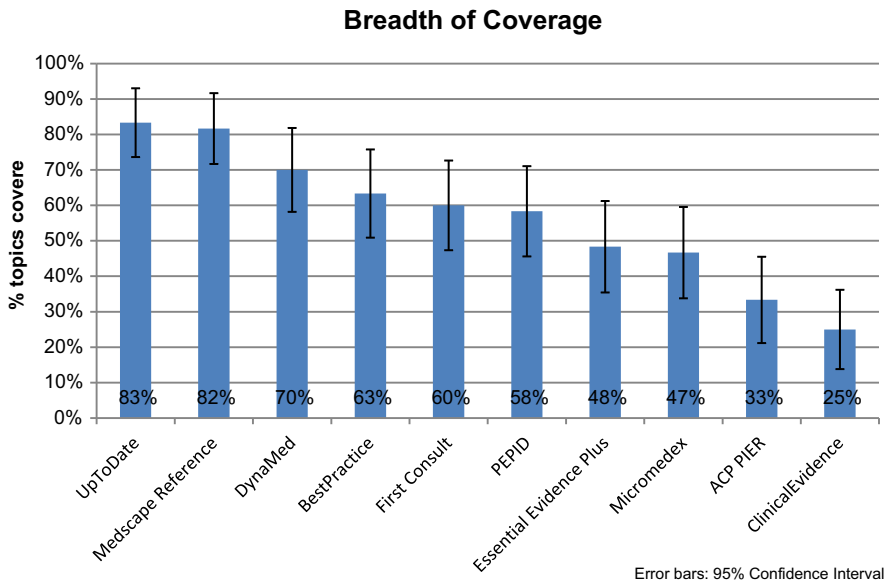


**Fig. 1.** Percentage of 60 ICD-10 codes covered by each of the selected online texts.

all three categories, suggesting that all could be improved. Two texts, however, consistently ranked near the top of each category, namely DynaMed and UpToDate. Conversely, with the exception of PEPID, none of the resources ranked consistently low across all categories. Each of the remaining texts ranked well in at least one category.

Features most often needing strengthening included providing new evidence tabs and user alerts. New evidence tabs can explicitly identify what new studies and systematic reviews have been published since a given topic was last updated, allowing the user to determine whether any change in recommendation needs to be considered. User alerts, delivered by e-mail or RSS feeds, and tailored to users' discipline or topic preferences, can make it more convenient for clinicians to keep up to date.

Our methodology involved rank ordering the texts, giving equal weight to each of the three evaluated areas. Some may argue that one of the three areas may be more or less important than the other and therefore the weighting should not be equal. This criticism, however, has been countered by Streiner and Norman [6], who have indicated that category weighting does not matter in the end, based on demonstrations with a wide variety of personality and health status measures.

Banzi et al. [4] used three measures that are conceptually similar to those used in our research: editorial quality, editorial methodology, and a measure of volume/breadth of coverage. The editorial quality and editorial methodology scores aim to assess similar criteria as our quality assessment measure. We also used similar methodology to Banzi et al.'s volume/breadth measure; however, we randomly

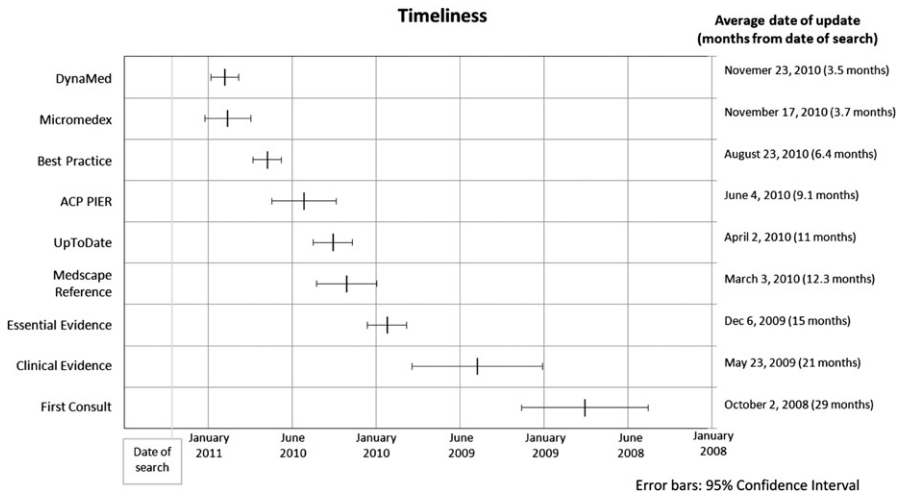


**Fig. 2.** Timeliness of updates of each of the selected online evidence-based texts.

**Table 3.** Rank ordering of the 10 evaluated online texts

| Text | Timeliness | Breadth | Quality |
|---|---|---|---|
| DynaMed | 1 | 3 | 2 |
| UpToDate | 5 | 1 | 2 |
| Micromedex | 2 | 8 | 2 |
| Best Practice | 3 | 4 | 7 |
| Essential Evidence Plus | 7 | 7 | 2 |
| First Consult | 9 | 5 | 2 |
| Medscape Reference | 6 | 2 | 9 |
| Clinical Evidence | 8 | 10 | 1 |
| ACP PIER | 4 | 9 | 7 |
| PEPID | N/A | 6 | 10 |

selected 60 ICD-10 codes for our assessment, whereas Banzi et al.'s work was based on four randomly selected ICD-10 topics. Banzi et al.'s research assessed 18 point-of-care products, eight of which were included in this study. We additionally examined Essential Evidence Plus and Best Practice. In a more recent report, Banzi et al. [7] used a different methodology to assess timeliness of updating, looking at citation of 128 systematic reviews. We compared our results to Banzi et al.'s published data. Our quality assessment measure was not found to be significantly correlated with Banzi et al.'s editorial quality measure ($r = 0.04$; 95% CI: −0.68, 0.72), nor the editorial methodology measure ($r = 0.66$; 95% CI: −0.08, 0.93). It should be noted however, that these analyses were conducted on only eight points of comparison. Even with the low number of texts in common, our breadth of coverage measure was significantly correlated with Banzi et al.'s volume measure ($r = 0.83$; 95% CI: 0.31, 0.97). For timeliness of updating, our methods and Banzi et al.'s differ [5]; the findings matched for the highest ranked text, DynaMed, but differed somewhat for other texts. Although our methodology was conceptually similar to previous studies, further research is needed to develop validated criteria for an index of quality, usability, and usefulness for researchers and, more important, information users to apply to online medical texts.

Although we attempted to build on the methodologies of others, our research has several limitations. Of particular note, the quality assessment measure is subject to the information made publicly available by each of the texts regarding editorial policies and procedures. The provided information was taken at face value as we are not able to verify that the publishers are actually following their stated policies and procedures. If a publisher does stray from the outlined production processes, the resulting score on our quality assessment measure may be inflated. This could only be determined through direct contact and documentation from the publishers, which was not undertaken in this study. Publishers may also have internal editorial policies, which could affect their quality assessment score. This was also not assessed in the present study but may be considered for future work. Moreover, the quality of the information on which the summaries and conclusions in the online texts are based was not assessed, as this was beyond the scope of the present study.

Navigability, search engine features and success, and ease of use were not assessed in this study, and these are likely to be important to users. Cost is also important but we did not assess this. Our study also did not assess conflicts of interests and independence of text authors. However, online texts were selected which did not include advertisements, minimizing this potential source of bias. There are also other online medical texts that were not examined in this study but which are consulted by many users.

When assessing breath of coverage, every effort was made to find the appropriate information in a text's chapter. However, it is possible that information pertaining to a specific ICD-10 code search term may have been deep within a chapter and difficult to retrieve. In such a case, this information could have been missed. Consequently, breadth of coverage would appear lower than it actually is. To minimize the chance of this occurrence, breadth of coverage was assessed independently in duplicate. Moreover, any reference to an ICD-10 code search term that would be so difficult to retrieve would likely be quite brief and not warrant a score of full coverage.

Several broader methodological challenges also exist. As previously stated, this study used surrogate outcomes for process of care and patient outcomes. Although the surrogate outcomes were grounded in theory, it is possible that they are not reflective of clinicians' translation of evidence to practice or consequent improvement of patient outcomes. A Cochrane review by McGowan et al. [8] examining information interventions found that none of the studies reviewed included process of care or patient outcomes. Validated measures will need to be developed and implemented to study these important outcomes directly. Although a randomized controlled trial would be the ideal methodology, where different information sources might be randomly assigned to clinicians, and process of care and patient outcomes measured, this is not practical or feasible. It would be near impossible to control for co-intervention, as clinicians have access to a variety of informational services. Given the wide variety of topics covered by the summary texts, it would also be extremely challenging to measure process of care and patient outcomes in a coherent and meaningful way. Therefore, at this stage, using surrogate outcomes is a first step toward establishing quality criteria to use to judge online medical texts.

The application of the quality assessment scale to Essential Evidence Plus and Micromedex resulted in two points of disagreement between the research staff (J.C.P., E.C.I.) for criterion 7 (indication of a schedule for updating chapters). Essential Evidence Plus indicated that its producers "review journals each month." It was debated whether this could be extrapolated to mean that chapters are updated each month. Likewise, Micromedex indicated that "references are added quarterly." Once again it was not clear whether chapters were actually updated with content quarterly. In keeping with our decision to take editorial process statements at face value, we awarded both these

publications the score for this criterion. However, this illustrates the need for clear, transparent, and explicit information regarding editorial processes. This would make quality assessment clearer for users and provide them with more confidence in the decision they make to consult or not consult that particular resource.

PEPID received the lowest score on the quality assessment scale largely because we could not locate information regarding its processes for gathering and evaluating content, updating chapters, and general editorial policies. Although it is possible that an entirely rigorous process is in place, this is not made known or available to the user (the perspective we were assuming). We considered marking PEPID as ''not evaluable'' instead of assigning scores of 0 to the missing criteria. However, we believe that information regarding the quality and performance of an online text that claims to be evidence based (http://www.pepid.com/primary-care-plus/, accessed October 11, 2011) should be made available to users.

Transparency in production processes is important for all online texts. Through gathering data and scoring texts, it seemed apparent to us that several resources' pages regarding production and editorial processes are written with a marketing bias. Although this is understandable as publishers aim to be competitive in the current market, it is also important that this be backed with the information necessary for users to educate themselves about a resource in more specific terms.

Clinicians have preferences as to how they obtain information and which resources they consult, as demonstrated in the work of Shariff et al. [2]. However, our results suggest that no single resource is uniformly best. Clinicians may wish to use one that ranks higher in the category of most importance to them, whether that be the latest information, the broadest scope of topics, or the highest quality evidence. Most likely, however, clinicians will often need to consult more than one resource when seeking an answer to a clinical question as no single resource is ideal. Searching multiple resources has become convenient with the advent of federated search engines. Clinicians must also be cognizant of the sometimes limited role of evidence-based information in making clinical decisions with individual patients. Additional key elements of the decision include the circumstances of the patient, including the local availability of treatment options and the patient's preferences [9].

In conclusion, our analysis of 10 online medical texts demonstrates great variability among texts in quality, breadth of coverage, and timeliness of updates. Nevertheless, many texts appear to be upgrading the quality, timeliness, and breadth of their topic coverage. This competition in the marketplace for providing frequently updated, evidence driven texts can only be good for clinicians and their patients. Although some texts rank highly across the three evaluated areas, most of the texts rank well in only one of the areas. No single online text appears to be ideal and clinicians are well-advised to consult more than one text, especially if the topic of interest in a text has not been updated recently. Use of federated search engines may be one avenue for clinicians to quickly consult high-quality information from multiple resources. Meanwhile, this evaluation provides a guide for clinical readers on which texts to consult first, and for editors, authors, and publishers on areas of strength and weakness in their texts.

## Acknowledgments

Competing interests: McMaster University has nonexclusive contracts, managed by the Health Information Research Unit, with several publishers, to supply newly published studies and systematic reviews that are critically appraised for research methods and assessed for clinical relevance. This service is formally used for updating online textbooks by Best Practice, Clinical Evidence, DynaMed, First Consult, and ACP PIER. UpToDate also lists two of our services (Clinical Evidence; ACP Journal Club) as resources.

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## Appendix

### Supplementary data

Supplementary data related to this article can be found online at http://dx.doi.org/10.1016/j.jclinepi.2012.05.003.

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