Qualitative Review of Web-Based Professional Education on Antibiotic Prescribing for Children: 10 Million Hits, but Only 10 Good Web Sites

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A structured Web-based search was performed to identify online educational programs on the optimal use of antibiotics in children. Identified Web sites of interest were classified using predefined quality criteria for educational Web resources. Of 10 Web sites identified, only 2 met all the quality criteria: APUA and Getsmart.

Key words. antibiotics; education; children; web site

Poorly targeted antibiotic prescribing and antimicrobial resistance are major concerns worldwide, especially in children [1, 2]. Lack of knowledge about infectious diseases, microbiological testing, and the appropriate choice of antimicrobials play a role in inappropriate prescribing practices [3]. At present, the limited training of basic pharmacology of antimicrobial agents, their modes of action, spectrum of activity and issues relating to resistance in many medical school curricula result in poorly informed prescribers [4]. Education for junior doctors and healthcare professionals is part of the national and international strategies for the control of antimicrobial resistance [5, 6]. Lack of access to up-to-date information can result in prescription of antimicrobials that are no longer effective in the face of emerging resistance or in the unnecessary use of broad-spectrum antimicrobial agents [7].

Different educational interventions have been proposed to limit the extent of inappropriate antibiotic use, with limited impact in ambulatory care [8]. The Internet offers many advantages compared with other information systems: it provides access to a large amount of information, especially for individual specialists; it can be flexible and interactive, permitting the use of images or video clips; and it allows linking to multiple Web sites on a specific subject, thus potentially further expanding knowledge. Web-based education tools potentially provide easy-to-reach, regularly updated information through multifaceted approaches that are known to be more effective than a single approach [8]. This review targeted healthcare professionals to identify and evaluate the global Web-based educational resources on optimal use of antibiotics in children.

MATERIALS AND METHODS

A relevant educational tool was defined as providing healthcare professionals with advanced and concentrated training in the targeted subject. The content of interest of the educational tool was the diagnosis and treatment of frequent pediatric infections. In particular, Web sites were assessed as to whether they contained information on the microorganisms involved, antimicrobial treatment options, and antimicrobial resistance through multifaceted approaches. Only English language Web sites were considered eligible for inclusion.

A Web search was performed in May 2012. In the absence of a validated systematic method of searching for Web sites, our approach was based on the electronic literature review methodology [9]. First, Web sites of institutional healthcare organizations, of societies involved in infectious diseases and/or in pediatrics and relevant international discussion forums, were screened to identify any educational tools for antibiotic prescribing in children (see the...
list in Appendix 1). Then, 2 Google searches combining the following free text terms using the Boolean operator “AND” were conducted: “Antibiotics,” “Education,” “Children” and “Antibiotics,” “Children,” “Healthcare professionals,” and “Web site.” Only the first 200 hits identified via the Google search were screened for each key word used, because of redundancy or limited relevance of further hits.

The quality of available resources was established by following the classification proposed for evaluation of educational Internet resources [10, 11], which has been adapted for medical resources [12, 13]. Key areas of assessment were as follows:

- Authority: Which persons or organization created the information and what expertise, knowledge, or skills do they have in the area?
- Objectivity/reliability: Is the information objective or subjective? Is it factual or does it reflect opinion? Is it accurate?
- Authenticity: Is the information delivered from an established organization? Are primary or secondary sources of information used? Are the original sources clear and documented? Is a bibliography provided citing the resources used?
- Timeliness: Is the information current and the site regularly updated, at least once per year?
- Relevance for the targeted audience: Does the audience consist of those providing medical care to children? Is the information helpful for this audience? Is the information of appropriate breadth and depth?
- Accessibility and efficiency: Is the information easy to access (publicly available resources and quick to access), well presented and organized (ie, presence of table of contents, index, menu, and/or other easy-to-follow tools for navigation), easy to use (ie., fonts, graphics, headings)?

A 3-tiered quality scale was then defined: 0, criterion not met; 1, criterion incompletely met; 2, criterion completely met. The classification was done by one author (F. D.) and validated by consensus between the others.

At the screening stage Web site titles were reviewed. Titles clearly not related to the subject of interest and those dedicated to patient and parent education, links to .pdf, .doc, or .ppt files that did not propose a multifaceted approach to articles, articles databases, or newspapers articles were not considered (Figure 1). In a second step, Web sites were visited; those mainly referring to previously identified sites for educating healthcare workers in the management of common infectious diseases in children, Web sites dedicated to parents or patients, sites that could not be reached or that needed an institutional login, sites lacking educational materials on common infections in children, promotional sites, or sites sponsored solely by the pharmaceutical industry were rejected.

Figure 1. Diagram flow of the identification and selection of Web sites of interest.

*Figure 1. Diagram flow of the identification and selection of Web sites of interest.

<table>
<thead>
<tr>
<th>Institutional Web sites of health care organizations and forum</th>
<th>Web sites of Societies involved in infectious diseases and/or in paediatrics</th>
<th>Google search with first line key-words n = 9700000</th>
<th>Google search with second line key-words n = 2790000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checking of links</td>
<td>Web sites of potential interest</td>
<td>Reading of the first 200 hits</td>
<td>Rejected links:</td>
</tr>
<tr>
<td>N = 14</td>
<td>N = 17</td>
<td>N = 20</td>
<td>- purposes out of subject, n = 99/35</td>
</tr>
<tr>
<td>Web sites of interest</td>
<td>Visits of Web sites</td>
<td>N = 24</td>
<td>- patient/parents education, n = 5/18</td>
</tr>
<tr>
<td>N = 2a</td>
<td>Rejected Web sites:</td>
<td>N = 19</td>
<td>- PDF, DOC or PPT files, n = 71/44</td>
</tr>
<tr>
<td></td>
<td>- No results found, n = 3</td>
<td></td>
<td>- Articles, abstracts or newspapers, n = 30/59</td>
</tr>
<tr>
<td></td>
<td>- Educational materials but not on this topic, n = 19</td>
<td></td>
<td>- Healthy life, n = 8/1</td>
</tr>
<tr>
<td></td>
<td>- Fee or institutional login required, n = 5</td>
<td></td>
<td>- Others, n = 37/19</td>
</tr>
<tr>
<td></td>
<td>- dedicated to parents or patients, n = 2</td>
<td></td>
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<tr>
<td></td>
<td>N = 10</td>
<td>Rejected Web sites:</td>
<td>No results found, n = 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Educational materials but not on this topic, n = 1</td>
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<tr>
<td></td>
<td></td>
<td>- referred to (an)other identified site(s), n = 3</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- dedicated to parents or patients, n = 4</td>
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</tbody>
</table>

*a/n: number of links rejected for each Google search
bThose 2 were also identified in the Google search
RESULTS

The Google search identified 9 700 000 results with the key words “Antibiotics, education, children,” and 2 790 000 results with the key words “Antibiotics, children, healthcare professionals, Web site.” Most of the Web sites identified were excluded during title scanning. For the Google searches, 10% and 12% of the Web sites, respectively, were of potential interest with some identified more than once. Web site review led to the exclusion of further links mainly on the basis that they referred to other identified sites for educating healthcare workers (n = 30) or because they were educational tools for parents or patients.

Among institutional healthcare organizations, forums, and societies involved in infectious diseases and/or in pediatrics, 31 sites of potential interest were identified. On detailed review of the content, only 10 Web sites addressed the relevant subject as previously set out (see Table in Appendix 2). Among these, only Alliance for the Prudent Use of Antibiotics (APUA; www.tufts.edu/med/apua/practitioners/stewardship.shtml) and Getsmart from the Center for Disease Control and Prevention (www.cdc.gov getsmart/speciﬁc-groups/healthcare-providers.html) had maximum scores on all quality criteria and shared useful resources on educational programs for improving use of antibiotics in children.

DISCUSSION

Ten eligible Web sites aiming to educate physicians on appropriate antimicrobial prescribing in common infectious diseases in children were identified through our systematic Web search, generating approximately 10 million hits. Of these, only 2 scored fully on all quality criteria. Timeliness and relevance were the main weaknesses for the eligible Web sites that did not fulfill all quality criteria. Some sites scored low on relevance because of a focus on physicians providing care for adults and failure to take into account key issues of infections in children. Contrasting with this result, a substantial proportion of actual and often unnecessary antibiotic prescribing is for young children, frequently provided by general or family practitioners without extensive pediatric training and with a mixed clientele covering all age ranges [16]. Therefore, providing information and education on good pediatric antibiotic prescribing practices to physicians is an essential element of any program designed to influence antibiotic prescribing behavior and can provide a foundation for community stewardship strategies [6]. Of course, in addition to improved educational practices, additional interventions are required to change antimicrobial prescribing behavior and to achieve a sustained impact [6, 8].

The World Health Organization recommends offering appropriate undergraduate and postgraduate healthcare provider education programs and ensuring continuous prescriber access to up-to-date prescribing literature on individual drugs [7]. The infectious diseases specialty is constantly evolving with the emergence of previously unknown or poorly understood pathogens and changing antimicrobial availability and utility in the face of changing resistance patterns. Expanding medical knowledge (not only in infectious diseases) has to be integrated using innovative educational methods to allow for more efficient use of resources [17]. The use of Internet Web sites may be one efficient way to provide a flexible, updated, and easy to maintain educational tool, with access to knowledge presented in various formats and using multifaceted approaches. Indeed, interactivity, practice exercises, repetition, and feedback are possible, and in a recent review seem to be associated with improved learning outcomes, although inconsistency across studies does not allow firm conclusions [18]. If well designed, the information retrieval process can be easy and less time-consuming than that of classical teaching methods. Self-evaluation and feedback can also be easily provided.

Although a systematic search was conducted, this study may not have identified all eligible sites in English. To increase the reproducibility and reliability of the search, evidence-based practice guidelines for systematically searching Internet sites were used [9]. Likewise, quality criteria chosen were specific and adapted to medical resources [12] to strengthen our analysis. Although only English Web sites were considered, interesting and useful sites in other languages may be available.

Because only a few high-quality sites could easily be identified and mainly originated from North America, sites specifically dedicated to Europe may be useful. Although Europe and North America are high-resource areas, antimicrobial resistance and antibiotic use show regional variability [19]. Antimicrobial consumption and resistance rates in Europe have been extensively described for adults, but European pediatric data are sparse. To increase their relevance to pediatricians, educational programs should ideally reference local epidemiology and antimicrobial resistance patterns. To avoid the limitations created by language barriers, new educational tools could be made available in different languages. A Centers for Disease Control and Prevention-like Web-based educational tool for European countries may be a first step to improving knowledge relevant to optimized antibiotic prescribing for children.

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References