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GAMBA, Fiorenza, *et al*.

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Original article

Comparison of Quality of Internet Pages on Human Papillomavirus Immunization in Italian and in English

Alberto Eugenio Tozzi, M.D.[a,*], Paola Sabrina Buonuomo, M.D.[a], Marta Luisa Ciofi degli Atti, M.D.[a], Emanuela Carloni, D.Stat.[a], Marco Meloni, D.Comm.Sc.[b], and Fiorenza Gamba, D.Phil., D.Sociol, Ph.D.[b]

[a]*Bambino Gesù Hospital, Rome, Italy*

[b]*Department of Sociology and Communication, Sapienza University, Rome, Italy*

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Abstract

Purpose: Information available on the Internet about immunizations may influence parents' perception about human papillomavirus (HPV) immunization and their attitude toward vaccinating their daughters. We hypothesized that the quality of information on HPV available on the Internet may vary with language and with the level of knowledge of parents. To this end we compared the quality of a sample of Web pages in Italian with a sample of Web pages in English.

Methods: Five reviewers assessed the quality of Web pages retrieved with popular search engines using criteria adapted from the Good Information Practice Essential Criteria for Vaccine Safety Web Sites recommended by the World Health Organization. Quality of Web pages was assessed in the domains of accessibility, credibility, content, and design. Scores in these domains were compared through nonparametric statistical tests.

Results: We retrieved and reviewed 74 Web sites in Italian and 117 in English. Most retrieved Web pages (33.5%) were from private agencies. Median scores were higher in Web pages in English compared with those in Italian in the domain of accessibility ($p < .01$), credibility ($p < .01$), and content ($p < .01$). The highest credibility and content scores were those of Web pages from governmental agencies or universities. Accessibility scores were positively associated with content scores ($p < .01$) and with credibility scores ($p < .01$). A total of 16.2% of Web pages in Italian opposed HPV immunization compared with 6.0% of those in English ($p < .05$).

Conclusions: Quality of information and number of Web pages opposing HPV immunization may vary with the Web site language. High-quality Web pages on HPV, especially from public health agencies and universities, should be easily accessible and retrievable with common Web search engines.

Keywords: Human papillomavirus vaccine; Internet; Information disemmination; Immunization programs

Following the recent availability of human papillomavirus (HPV) vaccines, immunization strategies targeted toward adolescent females have been planned and implemented in several countries [1,2]. Information strategies for promoting HPV immunization are challenging because they promote prevention of a sexually transmitted disease that may occur several decades after immunization, and because they touch sensitive issues such as sexual behaviors. Therefore it is understandable that, although safety and efficacy of available vaccines have been clearly demonstrated [3], concern regarding immunization strategies has been raised by the public and by the parents of adolescents [4]. However most parents included in published surveys have expressed a considerable interest in adolescent female immunization, and most of them have been in favor of immunizing their children [4–9]. On the other hand, studies conducted in Europe suggest that most parents would need more information about HPV and HPV immunization [9–11].

After licensure of one HPV vaccine in the United States (U.S.) in June 2006, the Centers for Disease Control and

*Address correspondence to: Alberto E. Tozzi, M.D., Bambino Gesù Hospital, Piazza S. Onofrio, 400165 Rome, Italy.

E-mail address: alberto.tozzi@gmail.com

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Prevention issued in 2007 specific recommendations for immunization of 11–12-year-old female adolescents and for catching up 13–26-year-old females [2]. In 2008 a national HPV immunization program was implemented in Italy as well [1].

Current statistics speak of 74% of Internet penetration in the U.S. and 48% in Europe as of June 2008 [12]. With the progressive increase of Internet use, Web resources are often used to search health information in Europe and in the U.S. [13]. People mainly use the Internet to gather additional information after a consultation; to access more complex information about a symptom, a disease, or a treatment; to look for information about healthy lifestyles or healthcare services; to participate in online support groups; and to be aware of other treatment alternatives [14]. Recent studies indicate that 75–80% of Internet users look online for health information and that the information they find online is helpful [15].

Although there is yet no evidence that information found on the Web is associated with the decisions of parents to vaccinate their daughters, HPV vaccination is a frequent search argument in Web search engines, as exemplified by search trends on Google [16]. On the other hand, quality and reliability of Web pages on immunizations may be questionable, and content may be flawed or may contain misinformation [17,18]. In addition, quality of Web pages on health may vary with the Web site language [19]. Considering these observations, the US Centers for Disease Control and Prevention has recommended to the public some simple principles for rating the accuracy of Web sites on vaccines [20], and several objective methods have been proposed for the systematic evaluation of quality of Web pages on health [21–24]. To assist readers in identifying reliable information, the World Health Organization has also set a list of criteria to which Web sites providing information on vaccine safety should adhere [25].

A recent study conducted in Italy showed that the level of knowledge on HPV of mothers of female adolescents targeted for immunization is low and that Internet represents a scarcely used source of information [26]. On the contrary, there is evidence that Internet is a significant information source on HPV for parents in the U.S. and that most of them are aware of HPV and HPV vaccine [27]. We therefore explored whether these different patterns correspond to different quality of available Web pages on HPV by language. To this end we evaluated the quality of Web pages on HPV vaccination retrieved with common Web search engines, and we compared Web pages in Italian and in English with respect to credibility, content, accessibility, and design.

Methods

Search string and search strategy

We used the following string for Web search: (HPV OR ''Human Papilloma Virus'' OR ''Papilloma'') AND (Vaccination OR vaccine OR immunization). We conducted two separate Web searches: one with the search string in Italian, and the other one with the same search string in English. The Web searches were conducted using the six most popular search engines in Italy and in the U.S. [28]. Specifically the engines used for the search in Italian were: Google, Yahoo, MSN, Libero, Virgilio, and Tiscali; those for the search in English were: Google, Yahoo, MSN, AOL, Ask.com, and Altavista. We launched the two searches on July 13, 2008. We arbitrarily decided to select the first 30 results obtained in each search engine; we recorded them in a database, and two separate lists of unique Web pages were created after eliminating duplicates.

To review the Web pages as they were found on the date of the search, we downloaded all resulting Web pages with an offline browser and copied them onto compact disks (CD-ROMs), which were distributed to all reviewers. We calculated the median rank achieved during the Web search considering the results in any of the six search engines.

Review process

To review the Web pages we adapted the Good Information Practice Essential Criteria for Vaccine Safety Web Sites recommended by the World Health Organization (WHO) [25]. To assign scores we reviewed the specific Web pages found through the search, the home page of the Web site, and the other Web pages considered relevant within the same Web site. Specifically, we assigned a score to each of four domains: credibility, content, accessibility, design. The score for each domain was obtained summing up the scores assigned to a list of criteria, where each satisfied criterion was assigned a score of 1.

The score for credibility varied from 0 to 6. Considered criteria included: transparency of the mission of the site; disclosure of ownership; transparency of sponsorship; accountability to users; evidence for data protection; and responsible partnering.

The score for content varied from 0 to 9; considered criteria included: authority of sources; attribution; information accuracy; information currency; transparency of the review process; quality of the standards of writing/editing; completeness; uniqueness; and provision of links to other resources.

The score for accessibility varied from 0 to 10; considered criteria were: consistency of availability of Web site; lack of large and unnecessary graphics; presence of instruction to download portable document format (pdf) files if available; presence of warnings before downloading large files; availability of user support service for technical support; lack of constraints to get back to a previous site or redirections to other sites; restrictions to access; presence of information on legality or distribution of material; appropriate and clear language; and readability of fonts and colors.

The score for design varied from 0 to 1 and evaluated the presence of a professional and pleasant design based on logical organization, ease of navigation, consistent plan, and professional presentation of the Web site.

Table 1
Type of Web sites analyzed in the review and links to public health/university or commercial Web sites, by language

	Web pages in Italian, N (%)	Web pages in English, N (%)	Total, N (%)	*p* Value
Private Web sites	23 (31.1)	41 (35.0)	64 (33.5)	.572
News	20 (27.0)	24 (20.5)	44 (23.0)	.297
Public health or University Web sites	17 (23.0)	22 (18.8)	39 (20.4)	.486
Drug or diagnostics companies Web sites	5 (6.8)	3 (2.6)	8 (4.2)	.150
Other	9 (12.2)	27 (23.1)	36 (18.8)	.060
Links to public health/universities Web sites	25 (33.8)	45 (38.5)	70 (36.6)	.513
Links to commercial sites	36 (48.7)	46 (39.4)	82 (42.9)	.204
No links	18 (24.3)	40 (34.2)	58 (30.4)	.149
Total, n (%)	74 (100)	117 (100)	191 (100)	

Web pages can have links to both public health/university and commercial Web sites.

The lists of items on accessibility and design were simplified with respect to those originally recommended by the WHO.

We also evaluated the presence of advertisement links to external commercial Web sites, and links to governmental or academic Web sites. Finally, Web pages were reviewed to assess if the content questioned or opposed the use of HPV vaccine. Web pages were considered against HPV immunization if they included a) an explicit recommendation not to vaccinate; b) an explicit statement on alternative methods of cancer prevention preferred to immunization (excluding Papanicolaou tests); c) a statement on insufficiency of proofs of efficacy or safety of vaccine to recommend its use.

Five reviewers (three pediatricians and two specialists in communication sciences) participated in a 1-day session to standardize the review process and to practice on a sample of Web pages. Pediatricians reviewed the credibility and content of each Web site, whereas specialists in Communication Sciences reviewed the accessibility and design domains. Each of the reviewers was then provided a CD-ROM copy of the Web pages and was assigned a random prespecified set of Web pages to be reviewed. A Web database with forms for evaluation of sites was built up, and access was granted to the reviewers. Reviewers assigned a score to each of the domains after reviewing the online and the offline versions of the Web sites and of the specific Web pages. The online revision was performed to assess consistency of availability of Web sites only (domain of accessibility). All reviewers were fluent in English and Italian.

Statistical analysis

We described and compared the scores of the Web pages obtained from the search in Italian with the score of the Web pages in English. Proportions are presented with their 95% confidence intervals, whereas scores in each domain are expressed as medians and interquartile ranges. The Mann-Whitney *U* test was used for comparisons across evaluation scales for credibility, content, and accessibility, whereas the Kruskal-Wallis test was used to compare scores by type of site. Distributions of type of Web sites, design score, and pages containing links to external Web sites or opposing HPV immunization were compared through the Chi square test or Fisher exact test when appropriate. The correlation between credibility and content, between accessibility and content scores, and between rank and scores was explored calculating the Spearman's rho. All statistical tests were considered significant at the .05 level. Stata version 9 was used for performing the analysis.

Results

We found a total of 191 Web pages from 156 Web sites, 74 resulting from the search in Italian (58 Web sites), and 117 from that in English (98 Web sites). There was no overlap between Web sites in the two languages. Distribution of type of Web sites is illustrated in Table 1. The majority of Web pages included in the review were from private Web sites delivering health information. The number of Web sites from news providers was also substantial, whereas those from public health agencies or universities were nearly 20%. A few Web sites were from drug or diagnostic companies, and one of the eight Web sites of this type contained specific information on one commercially available vaccine (http://www.gardasil.com). Other types of Web pages included blogs, forums, medical dictionaries or encyclopedias, and scientific article citations. The distribution of types of Web sites was not different between the search in Italian or in English. Scores for the various domains and for each item are illustrated in Table 2.

Scores in the domains of accessibility, credibility, and content were significantly higher for the Web pages retrieved with the search in English compared with those searched in Italian, whereas Web design scores were similar across the two groups. Significant differences in proportions of met criteria within each domain by language included the following: download instructions and presence of information on legality and distribution of material in the domain of accessibility; mission of site, transparency of sponsorship, and accountability to users in the domain of credibility; authority of sources, attribution, and standard of writing/editing in the domain of content.

We did not find significant correlations between scores in the domains of credibility, content, accessibility, and design,

Table 2
Comparison of scores in the domains of credibility, content, accessibility, and design, by language

	Web pages in Italian (N = 74)	Web pages in English (N = 117)	*p* Value
Accessibility			
Consistency of availability of Web site	100.0 (96.3–100)	100.0 (97.5–100)	1
Lack of large and unnecessary graphics	59.5 (48.0–70.2)	63.2 (54.2–71.6)	.599
Presence of instruction to download pdf files if available	18.9 (11.2–29.0)	36.8 (28.4–45.8)	.008
Presence of warnings before downloading large files	37.8 (27.3–49.3)	57.3 (48.2–66.0)	.008
Availability of user support service for technical support	56.8 (45.3–67.7)	62.4 (53.4–70.8)	.438
Lack of constraints to get back to a previous site or redirections to other sites	81.1 (71.0–88.8)	83.8 (76.2–89.6)	.633
Restrictions to access	45.9 (34.9–57.3)	48.7 (39.7–57.7)	.708
Presence of information on legality or distribution of material	52.7 (41.3–63.8)	68.4 (59.5–76.3)	.029
Appropriate and clear language	79.7 (69.4–87.7)	82.9 (75.3–88.9)	.580
Readability of fonts and colors	83.8 (74.1–90.9)	87.2 (80.2–92.4)	.511
Accessibility, median score (interquartile range)	7.00 (5.00–7.50)	7.00 (6.00–8.00)	.001
Credibility			
Mission of site	67.6 (56.3–77.5)	91.5 (85.3–95.6)	<.001
Disclosure of ownership/source	79.7 (69.4–87.7)	82.9 (75.3–88.9)	.58
Transparency of sponsorship	39.2 (28.6–50.6)	53.8 (44.8–62.7)	.05
Accountability to users	60.8 (49.4–71.4)	74.4 (65.9–81.6)	.048
Data protection	27.0 (17.8–38.0)	29.1 (21.4–37.8)	.761
Responsible partnering	33,8 (23.7–45.1)	34,2 (26.0–43.1)	.954
Credibility, median score (interquartile range)	3.00 (2.00–4.25)	4.00 (3.00–5.00)	.006
Content			
Authority of sources	29.7 (20.2–40.8)	53.8 (44.8–62.2)	.001
Attribution	55.4 (44.0–66.4)	74.4 (65.9–81.6)	.006
Accuracy	54.1 (42.6–65.1)	58.1 (49.0–66.8)	.580
Currency	54.1 (42.6–65.1)	59.0 (49.9–67.6)	.503
Review process	23.0 (14.5–33.6)	23.9 (16.9–32.3)	.879
Standards of writing/editing	41.9 (31.1–53.3)	58.1 (49.0–66.8)	.028
Completeness	17.6 (10.1–27.5)	29.1 (21.4–37.8)	.072
Uniqueness	17.6 (10.1–27.5)	17.9 (11.8–25.7)	.946
Provision of links to other resources	54.1 (42.6–65.1)	54.7 (45.6–63.5)	.930
Content, median score (interquartile range)	4.00 (2.00–6.00)	5.00 (3.75–6.00)	.005
Design			
Pleasant and professional design	51.4 (39.9–62.8)	60.4 (51.0–69.1)	.231

Proportions and 95% CIs are indicated for the items within each domain, whereas median scores and interquartile ranges are reported for the domain overall. Scores in each domain were calculated as the sum of single items within the domain. The maximum score for accessibility was 10, for credibility 6, for content 9, while for design a single item was evaluated.

and the median search rank in the search engines (credibility, $p = .421$; content, $p = .122$; accessibility, $p = .668$; design, $p = .767$). In addition, the median search rank was not significantly different across different types of Web site ($p = .361$), although media Web sites ranked highest and commercial Web sites lowest.

Table 3 shows the median scores in the four domains by type of site. Median scores in the domains of credibility, content, and design varied by type of site. Web sites from public health agencies or universities ranked highest, whereas Web pages including news ranked lowest. Accessibility scores were similar across all types of sites, while design was best in pages from public health agencies or universities.

Table 1 shows the frequency of links to public health agencies/universities or commercial sites included in analyzed Web pages by search language. Most Web pages retrieved and included in this review contained Web links, and many of them were to commercial Web sites. The distribution of links by search language, however, was not statistically different.

Scores in the accessibility domain varied with those in the domain of content (Spearman's correlation coefficient, .281; $p < .01$) and content scores were even more strongly correlated with credibility (Spearman's correlation coefficient, .568; $p < .01$). Seven of 74 Web pages displayed the HON code among the Italian Web pages compared with 12 of 117 from the search in English ($p = .871$). Finally, the number of Web sites opposing HPV immunization was significantly higher in Web pages from searches in Italian compared with those from searches in English (12% or 16.2% vs. seven or 6.0%; $p < .021$). Most Web pages opposing HPV immunization criticized the safety and tolerability of HPV vaccines or promoted a naturalistic approach to prevention.

Discussion

As immunizations are perceived among the most controversial health topics, it is expected that people search for information on HPV immunization increasingly on the Web. It

Table 3
Score distribution in the domains of credibility, content, accessibility, and design by type of Web site

	Web page source					
	Private Web sites	News	Public health or universities Web sites	Drug or diagnostics companies Web sites	Other Web sites	*p* Value
Accessibility, median score (interquartile range)	7.00 (6.00–8.00)	7.00 (6.00–8.00)	7.00 (6.00–8.00)	7.00 (5.25–7.00)	7.0 (6.00–8.00)	.584
Credibility, median score (interquartile range)	3.50 (2.00–5.00)	3.00 (2.00–4.00)	5.00 (4.00–6.00)	4.00 (2.25–4.00)	3.50 (1.25–5.00)	<.001
Content, median score (Interquartile range)	5.00 (2.00–6.00)	3.50 (3.00–5.00)	6.00 (5.00–7.25)	4.00 (3.25–4.75)	4.00 (2.50–6.00)	<.001
Design, percentage of pages with score = 1 (95% confidence interval)	50.0 (37.7–62.3)	45.2 (30.8–60.3)	82.1 (67.7–91.8)	50.0 (18.4–81.6)	56.7 (38.7–73.4)	.020

should be considered that information on immunization available on the Internet tend to be negative [29,30]. According to current literature, parental decisions about childhood immunization can be influenced more by perceived responsibility and anticipatory regret than by a numeric assessment of the risks and benefits of immunization [31]; high-quality information delivered by the Internet therefore may represent an efficacious mean to promote immunizations. Use of the Internet for searching health information may affect the use of health services, although it does not seem to replace in-person encounters with health personnel [32]. However a recent study on parental use of the Internet to search for health information did not find any relationship between parental use of the Internet and primary care use for children [13].

The differences in quality of information about immunizations on the Internet by language have not been explored so far, to the best of our knowledge. We therefore examined and compared, with the same methods, information retrieved in Italian and in English on HPV immunization using search engines widely used in Italy and in the U.S. Because information about this subject is often confusing to patients and may be challenging for clinicians to convey to patients [33], we believed that HPV immunization was a particularly suitable topic to conduct such assessment.

Our results showed that the number of unique Web sites retrieved in Italian was lower than the number of those retrieved in English using similar search strategies. This finding is in line with the large observed differences in the number of Web hosts by country [12].

Credibility, content, and accessibility ranked higher in English Web pages compared with those in Italian. Our evaluation of accessibility included several criteria for readability of Web pages. Some of these criteria were less frequently met in Web pages in Italian compared with those in English. On the other hand, the proportions of HON-certified sites, which takes into account readability requirements, were not significantly different by language. Improvement of readability will be essential to increase the efficacy of information delivery to the general public. Our data show potential for improvement also in the domain of content. It must be taken into account, however, that a comprehensive evaluation of this domain may be difficult [34].

Use of the Internet for searching for information on health varies by country, and interest in health issues may be lower in some countries compared with others [32]. Indeed, a lower level of knowledge on HPV, as measured in Italy compared with the U.S. in a previous study [26], coincides with a lower quality of information on the Web on the same topic, according to the results of the present study. It will be interesting to see whether an increased use of the Internet for searching for health information over time will correspond to an improvement in quality. However, since many of the Web sites about vaccine safety accredited by the WHO are in English [35], common quality standards should be more strongly recommended at an international level to improve information delivery in any language.

The criteria that we used for the review was derived from the WHO initiative ''Vaccine safety net,'' which had the scope of assisting readers in identifying Web sites that comply with quality criteria identified by the Global Advisory Committee on Vaccine Safety [25]. Although the published list of Web sites compliant with WHO criteria includes only few sites as of September 2008 [36], many of highest-scored pages reviewed in our study were included also in the WHO list. On the other hand, some of the WHO-accredited Web sites from Italy and from the U.S. that do include information on HPV immunization were not retrieved in our study. This finding suggests that Web pages with high-quality information on HPV vaccine may not be easily retrieved by common users.

Most Web pages retrieved in our search were from private Web site or from news providers, whereas sites from drug or diagnostic companies were rarely found. It is common that private Web sites host advertisements or other information to make profit. It is essential therefore that transparency in sponsorship, disclosure of information source, and links to external Web sites are carefully reviewed to assess quality of Web pages [35]. We involved in our review three pediatricians with expertise in HPV immunization to carefully evaluate content; we used an evaluation scale that included

relevant items regarding sponsorship and information source; and we analyzed the distribution of external links. We believe that this strategy may be considered suitable for the revision of quality of other Web sites on vaccines. Moreover, according to our results, credibility of Web pages was associated with quality of content and accessibility. This finding suggests that credibility criteria may be used as a first rapid screening to verify quality of Web pages on immunizations.

Scores in the domains of credibility, content, and design were higher in pages from public health agencies or universities. On the other hand we did not find any relationship between the search rank and the scores in various domains, or with the type of Web site. Because Internet users tend to focus on the first hits when using a Web search engine and public health agencies, scientific associations, and academies play a central role in information delivery on immunizations, appropriate strategies for search engine optimization should be pursued with the objective of placing their Web pages at the highest rank in popular Web search engines.

Although the number of Web pages questioning or opposing HPV immunization was lower than that observed in a study that recently analyzed the content of YouTube videoclips on HPV [37], those in Italian were twice as many as those in English. As many of the Web pages opposing HPV immunization in either language claim alleged side effects of the available vaccines or insufficient data on efficacy, information strategies should focus more strongly on these topics. Moreover, monitoring information available on the Web opposing immunization may be useful to better tailor information strategies.

To evaluate Web pages we used a scale derived by formal criteria indicated by WHO for Web sites on vaccine safety [25]. Although information evaluated in this study went beyond vaccine safety, we believed that those criteria were appropriate. No authority is responsible for evaluating the quality of information on the Web. The most-frequently used quality criteria include accuracy, completeness, readability, design, disclosures, and references provided. Study results and conclusions on health-related Web sites vary widely because of differences in study methods and rigor, quality criteria, study population, and topic chosen [38]. A common standard for the evaluation of quality of Web sites is desirable so as to better compare results from different studies.

As with any study on quality of Web pages, our study has the limit of including pages that may not be available after some time or that may be replaced by others. The number of Web pages on a specific topic also depends on requests by the public and on the news published on other media. Therefore monitoring quality of health information on the Web requires frequent assessments to follow changes over time.

We used for our study a search string in Web search engines based on a combination of key words focused on HPV immunization. A different search strategy using different key words may have resulted in a different collection of Web pages and in a different distribution of their characteristics. Our study did not include a direct evaluation of Web sites made by the target audience. It should be taken into account that information on a complex issue such as HPV immunization is challenging. A study performed on printed HPV educational material showed that quality and readability of selected material was less than optimal, suggesting that health professionals should involve the target audience in the preparation of educational material [33].

In conclusion, quality of information on HPV immunization available on the Web is subject to improvement and varies by language, although the vast majority of the available information in our study was positive about HPV immunization. The evaluation of Web pages including information on this subject may be useful to pediatricians to better address questions of parents of adolescent females who are candidates for immunization. Public health agencies or universities should make efforts for making their Web pages on HPV immunization easily accessible and retrievable with Web search engines. Because our study focused on differences between sites retrieved from Italy and from the U.S. only, other studies should investigate whether differences in quality exist also in Web pages in other languages. Future studies should also focus on the relationship between the quality of Web pages and impact on the target audience.

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