Availability of information in Public Health on the Internet: An analysis of national health authorities in the Spanish-speaking Latin American and Caribbean countries

David Novillo-Ortiz [a],*, Tony Hernández-Pérez [b], Francesc Saigí-Rubió [c]

[a] Office of Knowledge Management, Bioethics and Research, Pan American Health Organization (PAHO), United States
[b] Department of Library Science and Documentation, University Carlos III de Madrid, Spain
[c] Department of Health Sciences, Universitat Oberta de Catalunya, Spain

ARTICLE INFO

ABSTRACT

Introduction: Access to reliable and quality health information and appropriate medical advice can contribute to a dramatic reduction in the mortality figures of countries. The governments of the Americas are faced with the opportunity to continue working on this challenge, and their institutional presence on their websites should play a key role in this task. In a setting where the access to information is essential to both health professionals and citizens, it is relevant to analyze the role of national health authorities. Given that search engines play such a key role in the access to health information, it is important to specifically know – in connection to national health authorities – whether health information offered is easily available to the population, and whether this information is well-ranked in search engines.
Methods: Quantitative methods were used to gather data on the institutional presence of national health authorities on the web. An exploratory and descriptive research served to analyze and interpret data and information obtained quantitatively from different perspectives, including an analysis by country, and also by leading causes of death. A total of 18 web pages were analyzed. Information on leading causes of death was searched on websites of national health authorities in the week of August 10–14, 2015.
Results: The probability of finding information of national health authorities on the 10 leading causes of death in a country, among the top 10 results on Google, is 6.66%. Additionally, ten out the 18 countries under study (55%) do not have information ranked among the top results in Google when searching for the selected terms. Additionally, a total of 33 websites represent the sources of information with the highest visibility for all the search strategies in each country on Google for the ten leading causes of death in a country. Two websites, the National Library of Medicine and Wikipedia, occur as a result with visibility in the total of eighteen countries of the sample.
Conclusions: Taking into consideration that providing reliable and quality information on these topics to the population should be one of the priorities of national health authorities, these results suggest that national health authorities need to take measures to try to better position their contents.

1. Introduction

Even though public health in the Region of the Americas has experienced significant improvements over the last few decades,

challenges in prevention and control of diseases still prevail. Sub-optimal levels in maternal and child health, insufficient human resources and infrastructure, and the geographic and cultural differences throughout add complexities to the situation in the Region [1]. There are currently 23 principal causes of death, some of which are preventable. For instance, diabetes could be largely prevented through healthy diets and lifestyles; HIV/AIDS could be prevented through the adoption of the necessary precautions during sexual relations; and many sectors in society should confront the scourge of interpersonal violence with the integration of different strategies. [2].

In all of these cases, adequate medical counseling and the access to reliable and quality information could contribute to a dramatic

reduction in the mortality rates of these countries. Along with access to health information [3], the socialization and publication of comments on blogs and videos [4] have been identified as a tool that permits better empowerment and self-care of patients [5]. Patient-centered information is recognized today as the cornerstone of the amelioration of results and quality of healthcare [6], as it allows for both cost reduction [7] and the use of resources [8]. There is a steady increase of patients who are better equipped (i.e., they have the necessary knowledge to make decisions), better informed about the wide scope of topics related to healthcare [9–11], and who desire to use ICTs, especially the Internet, to communicate and share personal health information [12,13].

In Latin America and the Caribbean, a total of 188 million people are connected to the Internet. The percentages of penetration, however, are significantly varied; for instance, this can be seen when considering that a country like Chile as a rate of penetration of 72%, whereas Nicaragua has a rate of 17% [14].

Even though the reality is that not everyone has access to the Internet and that there is a significant amount of inequality in access, the variable related to the number of people who have access to the Internet is starting to have relevance with regard to decision-making in public health, and it justifies the presence of national health authorities on the Internet [15]. On the other hand, there are portions of the populations who play a more relevant role. The following factors play a role in affecting the use of the Internet in health: gender and the age of patients and citizens [16–18]; socio-economic factors, such as education and literacy [19,20]; health status [17,18,21–23]; psychographic indicators, such as people's trust in the Internet, their physicians or the healthcare system [24]. Youth and adolescents, aged 10–19, thus have a relationship with sexual and reproductive health. Since maternal and infant mortality is a worldwide concern and one of the main challenges for the upcoming years, providing appropriate information to young people will help keep them knowledgeable about and updated on relevant topics, such as teenage pregnancy and/or HIV/AIDS transmission.

Empirical evidence about inequalities in the use of the Internet in health is still under development [21,25,26], and not all investigations neither factor in the necessary variables [27,28], nor adequately adjust themselves to the factors that could boost the use of the Internet in health in an ever-changing digital landscape [16,25]. Although the provision of reliable and quality health information is one of the strategies of governments in the framework of public health, studies analyzing this presence are still not available.

Therefore, the main objective of this study is to analyze the role of national health authorities in responding to the need of citizens to access reliable and quality information on the leading causes of death, with the aim to identify the available challenges and opportunities, and thus provide recommendations on the design of public health policies. Specifically, we analyze the visibility or availability of information in the institutional websites of national health authorities in the Google search engine; the websites with the highest visibility in Google; and, finally, determine whether the health information that national health authorities offer through their websites is easily accessible to the population through their search engines.

2. Materials and methods

To address these realities, a study with the following research dimensions has been designed to analyze web rankings of the national health authorities (and competitors) concerning key words and synonyms representing the 10 leading causes of death in each country -extracted from Descriptors in Health Sciences (DeCS) and translated by PAHO- [29], as well as the availability of informa-

tion about the leading causes of death through the internal search engines in the websites of the national health authorities.

The research methods selected to undertake this research were the following: data collection by structured and direct observation about web presence of national health authorities and search of information about leading causes of death on their online institutional websites; and a comparative analysis by country and leading cause of death.

Quantitative methods were used to collect data useful to identify the institutional presence of national health authorities on the web. This quantitative approach was also useful to know what countries have information on the leading causes of death available for the general public.

Moreover, the exploratory and descriptive research served to analyze and interpret data and information obtained quantitatively from different perspectives, including an analysis by country, and also by leading causes of death.

The target population of this research consisted of 18 Spanish-speaking Latin American and Caribbean countries, and the national health authorities of their governments. These countries were: Argentina, Bolivia, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Uruguay and Venezuela.

The surveyed variables of these countries were their official websites – including use of internal search engines. A total of 18 web pages were analyzed. Information on leading causes of death was searched on websites of national health authorities in the week of August 10–14, 2015.

Data were collected by structured and direct observation. The observation was related to data collection about national health authorities' websites and web ranking. Fig. 1 shows the conceptual framework of the research design used (Fig. 1).

2.1. Exploratory and descriptive analysis

In terms of the objectives related to web ranking and identification of competitors, the following should be considered:

- The search engine used was Google [30], which controls 64% percent of the search [31].
- The keywords used were the same terms describing the leading causes of death, in Spanish.
- For this exploratory and descriptive analysis, the web ranking tool used was Advanced Web Ranking Cloud (AWR) [32], which allowed to search information and to analyze wanted indicators (see Fig. 2. Advanced Web Ranking Cloud Interface). Specifically, AWR was used to identify the ranking of national health authorities' web pages regarding information on leading causes of death. Moreover, this tool provided information on the best-positioned websites in terms of the theme analyzed. AWR allowed to extract two types of files. The file "Search engine comparison" was used for the analysis on ranking of national health authorities' websites and the file "Top sites" was used to analyze search results and identify sites with the highest visibility.

This exercise was conducted the week of 10–14 August, 2015.

2.2. Selection of terminology

For terminology selection, WHO official information was consulted, available on its website (http://www.who.int/) under the tag "Countries" [33]. This tag offers the health profile of each of the member countries of the United Nations system. It offers basic data for each country: information on life expectancy, information on the millennium development goals, the use of health services, expenditure on health per capita, and the 10 leading causes of
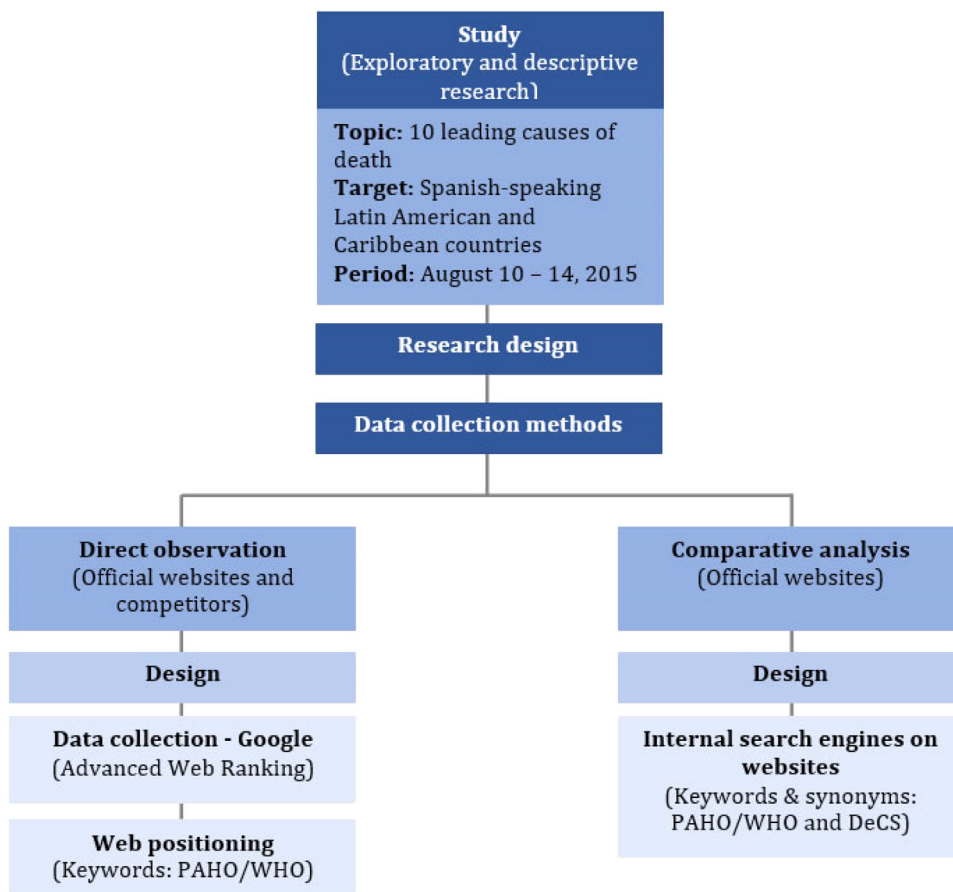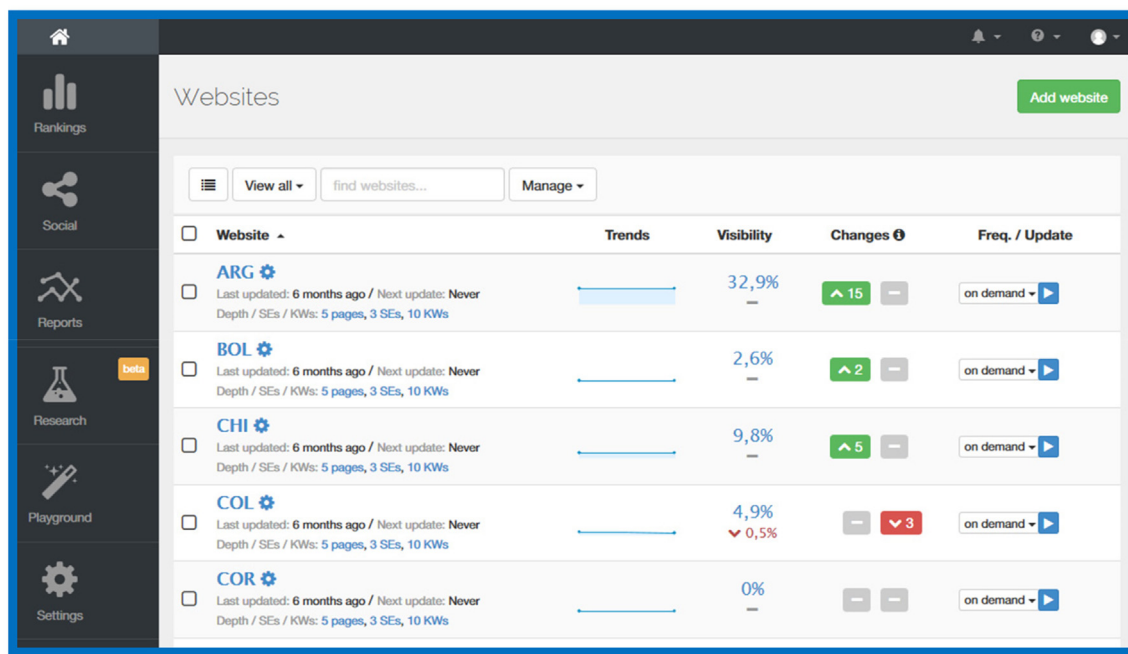
Fig. 1. Research design.

Fig. 2. Advanced Web Ranking Cloud Interface.

Table 1
Leading causes of death for the countries under study.

Leading causes of death (keyword)	

Stroke (*accidente cerebrovascular*)
  Affected countries:
  Argentina, Bolivia, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela.
	Hypertensive heart disease (*enfermedad cardiaca hipertensiva*)
	  Affected countries:
	  Argentina, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Mexico, Nicaragua, Panama, Paraguay and Venezuela.

Congenital anomalies (*anomalías congénitas*)
  Affected countries:
  Colombia, Honduras, Paraguay and Peru.
	Alzheimer's disease (*enfermedad de alzhéimer*)
	  Affected countries:
	  Chile, Cuba and Uruguay.

Birth trauma and asphyxia (*asfixia y trauma en el nacimiento*)
  Affected countries:
  Bolivia and Guatemala.
	Kidney disease (*enfermedad renal*)
	  Affected countries:
	  Argentina, Bolivia, Ecuador, El Salvador, Mexico, Nicaragua, Panama, Paraguay and Peru.

Colorectal cancer (*cáncer de colon y recto*)
  Affected countries:
  Argentina, Cuba and Uruguay.
	Diarrheal disease (*enfermedades diarreicas*)
	  Affected countries:
	  Guatemala and Honduras.

Stomach cancer (*cáncer de estómago*)
  Affected countries:
  Chile, Colombia, Costa Rica, Panama and Peru.
	Acute lower respiratory infection (*infección aguda de las vías respiratorias inferiores*)
	  Affected countries:
	  Argentina, Bolivia, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela.

Breast cancer (*cáncer de mama*)
  Affected countries:
  Uruguay.
	Traffic accidents (*lesiones en carretera*)
	  Affected countries:
	  Bolivia, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru and Venezuela.

Prostate cancer (*cáncer de próstata*)
  Affected countries:
  Costa Rica, Cuba, Dominican Republic and Uruguay.
	Protein-energy malnutrition (*malnutrición proteico-energética*)
	  Affected countries:
	  Guatemala.

Lung cancer (*cáncer de pulmón*)
  Affected countries:
  Argentina, Chile, Cuba, Uruguay and Venezuela.
	Chronic obstructive pulmonary disease (*neumopatía obstructiva crónica*)
	  Affected countries:
	  Argentina, Chile, Colombia, Costa Rica, Cuba, El Salvador, Honduras, Mexico, Nicaragua, Peru, Uruguay and Venezuela.

Ischemic heart disease (*cardiopatía isquémica*)
  Affected countries:
  Argentina, Bolivia, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela.
	Tuberculosis (*tuberculosis*)
	  Affected countries:
	  Bolivia.

Liver cirrhosis (*cirrosis hepática*)
  Affected countries:
  Argentina, Bolivia, Chile, Ecuador, El Salvador, Dominican Republic, Guatemala, Mexico, Nicaragua, Peru and Venezuela.
	HIV/AIDS (*VIH/Sida*)
	  Affected countries:
	  Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras and Panama.

Complications from premature birth (*complicaciones del parto prematuro*)
  Affected countries:
  Bolivia, Dominican Republic, Honduras and Paraguay.
	Interpersonal violence (*violencia interpersonal*)
	  Affected countries:
	  Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay and Venezuela.

Diabetes (*diabetes*)
  Affected countries:
  Argentina, Bolivia, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela.	

death. It is worth mentioning that this information was last updated by WHO in 2012.

From the analysis of the 18 countries under study, a total of 23 leading causes of death affecting these countries were identified. Since the official information on leading causes of death was provided in English language, the website of the WHO's Regional Office in the Americas was used for the translation into Spanish, mainly to guarantee the translation into the Spanish language used in Latin American countries (see Table 1. Leading causes of death for the countries under study). The website of WHO in the Americas is available at www.paho.org [34].

2.3. Comparative analysis

After the analysis of ranking, the Excel program was used to work with retrieved results.

To work with "web competitors" (to the country websites), after the analysis of retrieved results and visibility of the website of each national health authority was carried out, an analysis was con-

ducted to determine which websites were the most visible among the top 10 results for each strategy, formulated in Google, for each country.

To select web competitors in the analyzed space, the indicator "Search presence" was considered, assessing the 10 websites with higher presence in the searches conducted, followed by the number of times it appeared among the top 10 results (see Appendix A in Supplementary material. Websites with the best ranking on Google). In summary, the analyzed components were: the presence in searches (number of search strategies in which the website appears retrieved) and the position of results retrieved ranked among the top 10 results (because several results from the same website may appear on the same search, there may be more results than search presence).

Information retrieval through internal search engines of the websites under study was analyzed. The same keywords used for the searches in Google were used for these searches. Additionally; these searches were complemented with the use of synonyms for the leading causes of death; taken from the DeCS controlled

vocabulary (see Appendix B. List of keywords and synonyms on leading causes of death). Besides; *Google Trends* (www.google.com/trends) was used to detect other possible synonyms of the terms used to locate information on the leading causes of death [35]. The search revealed that there were no significantly different synonyms that might affect the total of retrieved results. In addition; it was observed that *Google Trends* generated enough traffic to get results for 14 out of the 23 terms used.

3. Results

3.1. Visibility of national authorities' websites

The visibility of national health authorities' websites in Google results page was analyzed after performing a search on the 10 leading causes of death (see Appendix C in Supplementary material. Ranking of national authorities' websites). As a reference, we took into consideration only the first 10 results of Google since several studies conducted between 2006 and 2014 showed that the top 10 search results on Google receive more than 75% of clicks from search users [36]. Some of the following findings were found:

- The possibility of finding information of national health authorities on the 10 leading causes of death in a country, in the top 10 results on Google is 6.66%.
- Nine of the 23 search strategies used – 39.13% – allow for the retrieval of information from national authorities' websites within the top 10 search results (Fig. 3).
- Fourteen of the search strategies used – 60.87% – in which the websites of the national health authorities did not come up within the top 10 search results (Fig. 3).
- Ten out the 18 countries under study – 55.50% – do not have information ranked among the top 10 results in Google when searching for the selected terms.

- Only the Argentinian and Chilean national health authorities' websites have information ranked for three out of the 10 leading causes of death in their countries, among the top 10 search results on Google.
- Countries with visibility for one out of the 10 leading causes of death in their countries are Colombia, Cuba, Ecuador, El Salvador, Guatemala, and Venezuela.

3.2. Websites with the highest visibility

A total of 33 websites represent the sources of information with the highest visibility for all the search strategies in each country on Google (see Appendix A in Supplementary material). Two websites, the National Library of Medicine and Wikipedia, occur as a result with visibility in the total of 18 countries of the sample.

Eight of the 33 websites, accounting for 24.2%, have a presence for at least 11 of the 18 sampled countries. These eight websites are (the number of countries for which this website has the highest visibility is shown in parentheses): National Library of Medicine (eighteen), Wikipedia (ES) (eighteen), World Health Organization (sixteen), Slideshare (ES) (fifteen), TuOtroMédico (fifteen), Escuela de medicina (twelve), CDC (USA) (eleven) and Elsevier (eleven).

From this analysis, we can conclude that the countries with national health entities (national health institutions, universities and hospitals, and health facilities) with the highest visibility on the web through an information search on Google are four, namely: Argentina, Chile, Mexico and Peru.

3.3. Information availability through the search engines of the national health authorities' websites

Regarding the availability of information about leading causes of death available to the general public through internal search engines of the national health authorities' websites, an informa-
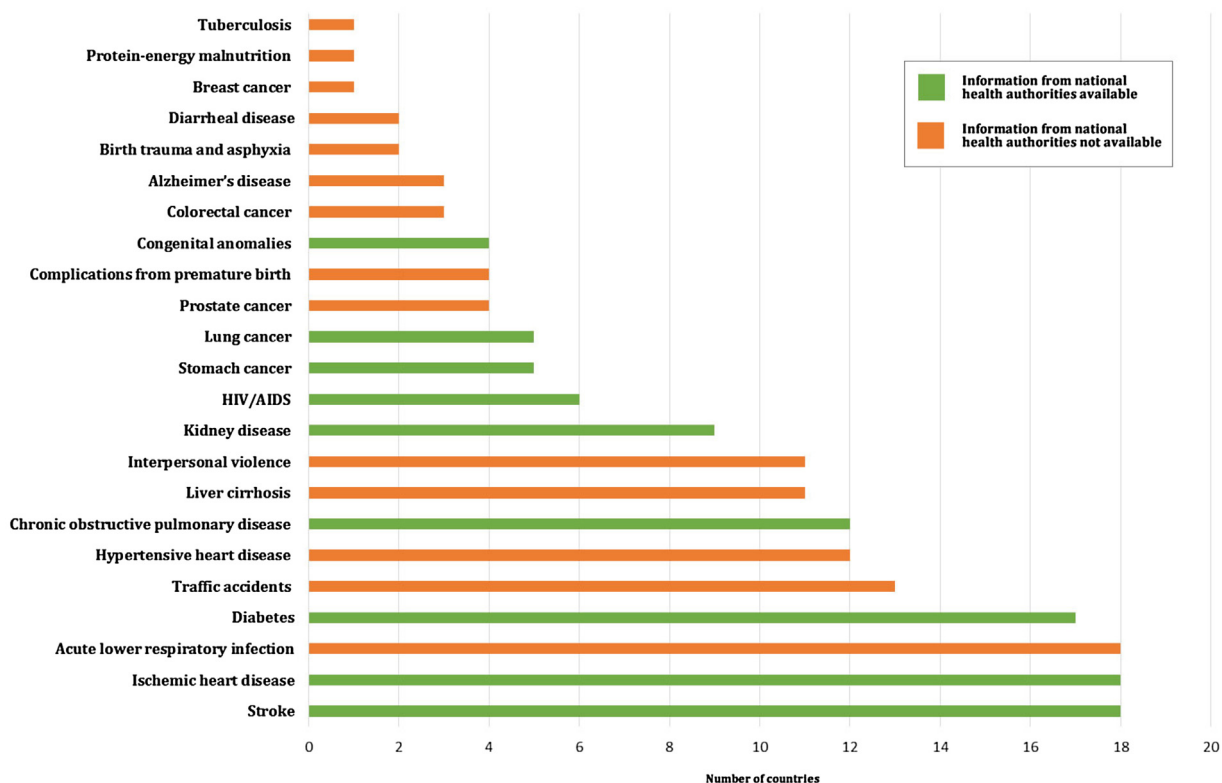

Fig. 3. Availability of information from national health authorities among the top 10 search results on Google.

Table 2
Information availability on the leading causes of death on national health authorities' websites by country.

Country (national health authorities' website)	Nbr. of causes retrieved using keywords	Retrieval using synonyms (DeCS)	Retrieval using keywords and synonyms	Total nbr. of leading causes of death with access
Argentina	3	4	1	6
Bolivia	4	4	1	7
Chile	4	4	2	6
Colombia	9	10	9	10
Costa Rica	6	10	6	10
Cuba	8	10	8	10
Ecuador	3	7	3	7
Dominican Rep.	3	4	3	4
El Salvador	5	8	4	9
Guatemala	1	4	1	4
Honduras	–	–	–	–
Mexico	–	–	–	–
Nicaragua	6	7	4	9
Panama	6	9	6	9
Paraguay	6	9	5	10
Peru	–	–	–	–
Uruguay	8	9	7	10
Venezuela	–	–	–	–
Mean values	5.14	7.07	4.28	7.92

tion retrieval exercise was performed for all the countries under study based on their 10 leading causes of death.

3.3.1. Analysis by country

Firstly, using the search engines of the national health authorities' websites, an analysis was carried out to identify the availability of information using keywords and synonyms for the 10 leading causes of death for each country (Table 2).

Considering that searches on the 10 leading causes of death, including keywords and synonyms, were performed in each website, the retrieval of information showed that average retrieval was around eight out of ten. To be precise, using the keywords and synonyms selected, information about eight out of the 10 leading causes of death on average were accessible; specifically, information on 7.92 causes was accessible (79.2%).

Regarding information retrieval, in five countries (27.77% of the study sample) – Colombia, Costa Rica, Cuba, Paraguay, and Uruguay – information on all the leading causes of death for those websites could be retrieved using the selected terms, while in three (16.66%) – El Salvador, Nicaragua and Panama – information could be retrieved for nine out of the 10 leading causes of death. In summary, eight websites of national health authorities (44.43%) allow for the retrieval of information with the selected terms. On the other hand, two websites – corresponding to Bolivia and Ecuador – allowed for the retrieval of information on seven out of the 10 leading causes of death. Finally, four websites (22.22%) – corresponding to Argentina, Chile, Guatemala, and Dominican Republic – allowed for the retrieval of information with the terms used for six or fewer leading causes of death. In the case of Argentina, Bolivia and Ecuador, it is worth mentioning that the fact that some of their internal search engines have a search limit of 20 characters may have affected the possibilities of retrieving a larger number of results. Conversely, in the case of El Salvador and Nicaragua, this restriction did not seem to be an obstacle on retrieving information.

3.3.2. Analysis by leading cause of death

Regarding the information search about leading causes of death, another perspective of interest was to identify which causes allow retrieving information and which causes do not, with the defined search strategies. This analysis consisted of indicating the cause name, the number of countries in which that cause is one of the leading 10, the number of times information was retrieved (both by keyword or synonym), and the number of times in which infor-

mation was not retrieved for a certain country. These results were also submitted as a percentage to facilitate understanding (Table 3).

After performing the analysis based on the possibility of retrieving information about the leading causes of death, it was identified that the average possibility of retrieving information about one of the leading causes of death, using the selected search strategies, was 82.57%.

Using both keywords and descriptors, the information about 10 of the 23 leading causes of death – accounting for 43.47% of the leading causes of death for the total countries under study – was retrieved in 100% of the cases through the search engines of the analyzed websites. The causes that were considered were (the number of countries where each condition is a leading cause of death is indicated in parentheses): congenital anomalies (four), breast cancer (one), lung cancer (five), complications from premature birth (four), Alzheimer's disease (three), diarrheal diseases (two), protein-energy malnutrition (one), tuberculosis (one), HIV/AIDS (six), and interpersonal violence (eleven).

Besides, in the case of the eight leading causes of death – accounting for 34.78% of the total – information was retrieved successfully, using the selected search strategies, 75% to 92.86% of the time (these causes are: diabetes, hypertensive heart disease, traffic accidents, chronic obstructive pulmonary disease, stroke, kidney disease, stomach cancer, and prostate cancer).

In summary, in the case of the 18 leading causes of death – accounting for 78.25% of the total leading causes of death of the countries under study – information was retrieved with a minimum rate of success of 75% on the websites of national authorities, using the selected strategies.

4. Discussion

New processes and communications, along with social and economic changes, are precipitating a rapid and significant change in the relationships that are established between actors in a healthcare transaction. Information and communications technologies (ICT), and especially the Internet, offer the potential to shift the attentions of healthcare from clinical centers to the daily lives of citizens, both for healthcare and for disease prevention. These developments in digital health (also called eHealth) raise the importance of evaluating the role of national health authorities to respond to citizens' need to access reliable and quality information about the leading causes of death.

Table 3
Information availability on national health authorities' websites by leading cause of death.

Cause of death	Nbr. of Countries	Retrieval (keyword and synonyms)	No retrieval	% Retrieval	% No retrieval
Stroke (*accidente cerebrovascular*)	14	12	2	85.80	14.20
congenital anomalies (*anomalías congénitas*)	2	2	0	100.00	–
birth trauma and asphyxia (*asfixia y trauma en el nacimiento*)	2	0	2	–	100.00
colorectal cancer (*cáncer de colon y recto*)	3	2	1	66.60	33.30
stomach cancer (*cáncer de estómago*)	4	3	1	75.00	25.00
breast cancer (*cáncer de mama*)	1	1	0	100.00	–
prostate cancer (*cáncer de próstata*)	4	3	1	75.00	25.00
lung cancer (*cáncer de pulmón*)	4	4	0	100.00	–
ischemic heart disease (*cardiopatía isquémica*)	14	7	7	50.00	50.00
liver cirrhosis (*cirrosis hepática*)	8	3	5	37.50	62.50
complications from premature birth (*complicaciones del parto prematuro*)	3	3	0	100.00	–
Diabetes (*diabetes*)	14	13	1	92.86	7.14
Hypertensive heart disease (*enfermedad cardiaca hipertensiva*)	10	9	1	90.00	10.00
Alzheimer's disease (*enfermedad de alzhéimer*)	3	3	0	100.00	–
Kidney disease (*enfermedad renal*)	7	6	1	85.72	14.28
Diarrheal disease (*enfermedades diarreicas*)	1	1	0	100.00	–
Acute lower respiratory infection (*infección aguda de las vías respiratorias inferiores*)	14	9	5	64.29	35.71
Traffic accidents (*lesiones en carretera*)	9	7	1	88.89	11.11
Protein-energy malnutrition (*malnutrición proteico-energética*)	1	1	0	100.00	–
Chronic obstructive pulmonary disease (*neumopatía obstructiva crónica*)	8	7	1	87.50	12.50
Tuberculosis (*tuberculosis*)	1	1	0	100.00	–
HIV/AIDS (*VIH/Sida*)	5	5	0	100.00	–
Interpersonal violence (*violencia interpersonal*)	8	8	0	100.00	–
Mean values				82.57	17.43

The role of national health authorities becomes particularly relevant in the issue of access to health information on the Internet, this being a real and ongoing challenge throughout Latin America and the Caribbean. The analysis of the visibility and availability of information in national health authorities' institutional websites, and their comparison in diverse socioeconomic and cultural contexts in Latin America, will allow us to know the challenges and opportunities present, will help us provide recommendations for the design of public health policies, and will help us avoid disparities in their use related to health status [37], especially in groups who bear a disproportionate burden of disease [21,38].

The number of Internet users has increased considerably in recent years; amongst the different uses of the Internet lays health [39–43]. Eight of the 10 health-related consultations were started through search engines like Google, Yahoo or Bing [44]. Also, one out of 20 searches on Google is related to health [45]. Similar to databases that facilitate decision-making in clinical practice, it has been proven that search engines like Google can become a helpful tool for the diagnosis of uncommon pathologies [46]. Considering total connectivity data, mean Internet penetration in the analyzed countries is 43.41%. In only five of the 18 countries the penetration rate is higher than 50%. These countries are Colombia, Venezuela, Uruguay, Argentina, and Chile. On the other hand, seven countries (Peru, Ecuador, Paraguay, Mexico, Panama, Costa Rica, and Dominican Republic) are in the connectivity area, with penetration rates ranging from 40% to 50% [14]. This increase in the consumption of health information across the Internet is a variable that national health authorities should take into account, mainly in relation to the publication of public health information that is available and accessible – be it by their presence on the Web or across social media – especially given the fact that national health authorities should be the main source of information for citizens who wish to be informed about public health issues. While this is a good opportunity to improve the sustainability and efficiency of the healthcare system, to date it is associated with a new set of challenges. Regarding visibility of national health authorities' websites, national health authorities still have much room for improvement in ranking on Google when it comes to searching for leading causes of death, and

it seems difficult that they will become one of the leading sources of information for people who search for health information on the Internet. Taking keywords used as a reference on Google, it is possible to retrieve information from the national health authorities' websites among the top 10 results for nine out of the 23 leading causes of death identified in the countries under study – 39.13%. This means that for 60.87% of the leading causes of death, it is not possible to retrieve information from the national health authorities' websites with the selected search strategies. In other words, when searching for terms such as "tuberculosis" (tuberculosis), "cáncer de mama" (breast cancer), "cancer de próstata" (prostate cancer)," or "cirrhosis hepática" (liver cirrhosis), among others, within the first 10 search results on Google, it is not possible to find information from national health authorities' websites from any of the 18 countries under study.

Furthermore, citizens cannot retrieve national health authorities' information on 10 of the 23 (43.5%) leading causes of death. This means that the content about these causes that is being recovered might not be as reliable and of the same quality as the content that the national health authorities provide. These 10 strategies are (the number of countries where each cause of death is one of the top 10 is indicated in parentheses): birth trauma and asphyxia (two), breast cancer (one), prostate cancer (four), liver cirrhosis (eleven), complications from premature birth (four), Alzheimer's disease (three), diarrheal diseases (two), traffic accidents (thirteen), protein-energy malnutrition (one), and interpersonal violence (eleven).

The main implication for public health due to national health authorities' lack of information visibility is the possibility of users encountering incorrect or inaccurate information, when searching for the main causes of death, that can lead to decisions that affect their health, which would also have an impact on health systems and services. In addition, an essential element of public health—health promotion—would also be directly affected since one of the main mechanisms of to which the population has access for disease prevention would not be functioning efficiently.

On the other hand, from the perspective of the websites with the highest visibility in the search for information on some of the

leading causes of death, citizens will find that Wikipedia is one of the sources of information with the highest visibility when looking for information on leading causes of death, based on the selected search strategies, and constitutes a source of information for all the countries in which the search strategies were launched. The National Library of Medicine also got the same results. These results show that information retrieval on causes of death through search engines may return results of variable quality regarding the sources of information and, consequently, in the information retrieved.

Some of these websites can in turn serve as a repository for and reference of the contents of national health authorities. For instance, websites like Wikipedia or Slideshare, two spaces with excellent visibility for the analysis performed, can be used to incorporate contents of national health authorities. Although the owners of the aforementioned content information are not allowed to edit entries of said content on Wikipedia, talks can be held with Wikipedia so that owners of the information can be invited to incorporate the contents of health authorities in their respective Wikipedia articles.

In the case of Slideshare, a possible strategy is the creation of an institutional profile where it is possible to save a copy of the contents national health authorities produce, mainly those presentations shared in different events and activities which, as gray literature, may be of considerable importance for citizens and health professionals. These actions, although simple, could produce a positive effect in improving the ranking of institutional contents. Considering the way in which information is consumed, national health authorities should have the capacity to extend the spaces in which their goals are disseminated.

These measures on Wikipedia or Slideshare would help the websites of national health authorities to improve their visibility among the first results of search engines (not just Google). Other measures related to the improvement of web positioning (Search Engine Optimization) that could be analyzed are the following: assess the possibility of including pay per result on search engines to ensure that priority issues for national health authorities can be visible among the information available on the search engines; access the list of websites with the highest visibility to examine the content offered for each country, get some possible ideas, and identify good practices to be applied to the strategy for information dissemination by national health authorities; and, finally, identify those institutions with good visibility and with which alliances, agreements and collaborations could be established from different perspectives. In the case of other national health entities, such as hospitals and health facilities, national health institutions, and universities, it will be important to ensure the integration of information with the minimum necessary information that should include that relevant topic and, if possible, develop a shared information visibility strategy to help promote that any of the entries to access information through the search engines will provide a minimum of quality and consistency.

When analyzing the information availability through the search engines of the national health authorities' websites, it was found that in all the websites analyzed it was more efficient to recover information using synonyms – the average rate of recovery using synonyms was 7.07 out of 10, compared to when using primary words. In this latter case, the average rate of recovery was 5.4 out of 10. Additionally, the average rate of recovery of information using keywords and synonyms at the same time was 4.28.

Those leading causes of death for which information is not retrieved with the same success through the selected search strategies require specific analysis. For the object of this analysis, we considered those causes for which information was not accessed with more than 70% effectiveness. These causes are: colorectal cancer, acute lower tract respiratory infections, ischemic heart disease, liver cirrhosis, birth trauma, and asphyxia. From these six causes,

it is worth mentioning that two of them, "acute lower tract respiratory infections" (with a retrieval rate of 64%) and "ischemic heart disease" (with a retrieval rate of 50%), are the leading causes of death for the 14 countries analyzed that have search engines in their websites. "Ischemic heart disease," particularly, is one of the leading causes with the highest fatality rate, not only for these countries but also at a global level, thus requiring specific analysis of terminology.

Statistics on the number of people connected to the Internet should be a key reference for identifying potential target audiences, as well as for the development of public health decision-making campaigns. In a short time, this group of Internet users will be pushing the national health authorities to offer new solutions (services and devices) when they have to deal with health issues. This situation will increase over the next decade as middle-aged individuals become elderly. The aging population and the increased level of comorbidities may lead to continually more complex needs for clinical care and for social support, undermining the foundations of the systems of healthcare and social care in Latin America and the Caribbean. National health authorities will have to face the challenge of not only having to provide reliable and quality health information today, but also to expand their services across the Web, in order to meet these new demands tomorrow.

4.1. Recommendations addressed to the Public Health authorities

Taking into consideration that providing reliable and quality information on these topics to the population should be one of the priorities of national health authorities, these results suggest that national health authorities need to take measures to try to position their contents in order to have better visibility and thus become the primary source of health information for their users. Some of the measures to be taken could be:

- Reviewing the vocabulary used when referring to public health-related terms, particularly to ensure that the terms used are the same every time a message is disseminated, as well as to ensure consistency to facilitate information retrieval. This review should consider whether the terminology used is the same that the public would use, taking into account that it would ultimately be citizens who will need to consult and receive advice on these contents.
- Forging alliances with non-traditional partners, such as Wikipedia, Slideshare or search engines, to ensure that citizens have access to reliable and high-quality health information. One example of an alliance with Google is "Knowledge Graph." In February 2015, Google activated health contents through this feature for US users of the search engine. This service has four sources of information: health websites (such as Medscape or WebMD), websites of governmental agencies of the United States (NIH, CDC, NLM, etc.), medical illustrators, and partners (such as the Mayo Clinic).
- Strengthening internal search engines so that they provide a useful tool for the people wanting to search for reliable and quality health-related information on these web spaces. This strengthening should consider, among other characteristics, the search capacity without character limitation by search strategy typed; the order of results with different options such as relevance, date or type of file (.pdf, .ppt, .xls, etc.); providing the number of results retrieved for search strategy performed; and the non-differentiation of accented and non-accented characters.

4.2. Limitations of the study

This study is limited to the geographical analysis of Spanish-speaking Latin America and the Caribbean. Therefore, based on the aforementioned, the language under study and analysis is Span-

ish. The idea of this delimitation was to guarantee the consistency of results and ease the comparison of results obtained from different countries. Special mention should be made of the exclusion of Brazil, the largest of the Latin American countries in population. This exclusion is exclusively due to methodological criteria, to guarantee the consistency of the terminology used. Nevertheless, the recommendations included in this study can be applied to any country wishing to work on strategies for the access to health information.

Regarding the institutions under study, the "national health authorities" of these countries are analyzed. Within the framework of this research, national health authority stands for those health institutions that, by constitutional mandate, are the governing body of public health in the country, i.e., ministries and secretaries of health at the national level. Specific sections of this research will extend this concept to "national health entities" meaning those national government entities working for the health sector, that are not necessarily a ministry or secretary of health. For the purpose of this research, national health entities are: hospitals and health facilities, national health institutions and universities.

From the 18 national health authorities' websites analyzed, it is worth mentioning that four – Honduras, Mexico, Peru, and Venezuela, all accounting for 22.2% of the total sample analyzed – did not have an internal search engine or did not permit searches on the results of that website; therefore, this part of the analysis considered only 14 out of 18 countries.

Due to the fact that evaluating the quality of the results retrieved on Google about the leading causes of death was not one of the objectives of this study, future investigations should also include the evaluation of the content of retrieved results, using tools such as DISCERN, HONcode, and JAMA benchmark criteria. Moreover, future work should investigate the types of search terms used by different types of users by age, education, socio-economic status, country, and urban or rural settings, considering that types of queries and search terms used by different people from diverse levels of education and socio-economic backgrounds will influence the search results.

Finally, even though the source of information used was different versions of the same search engines per country (e.g., Google Argentina, Google Dominican Republic, etc.), the risk of bias in the tool remains since all searches were conducted in the United States.

5. Conclusions

The results obtained show the need for more in-depth research in the field of access to and retrieval of health information. By doing this, it will be possible to provide national health authorities the necessary evidence to increase political strategy and public investment in a world where it is increasingly necessary to have reliable and quality information, especially when it comes to the health of populations and the leading causes of death.

The probability of finding information of national health authorities on the 10 leading causes of death in a country, among the top 10 results on Google, is 6.66%. Moreover, 10 out the 18 countries under study (55%) do not have information ranked among the top results in Google when searching for the selected terms. It is therefore necessary to augment access to reliable and quality information about the leading causes of death in order to increase the empowerment of citizens. The active participation of patients in their own care highlights the need for healthcare systems that are more transparent and responsive to the needs and demands of their users. Knowledge of the available challenges and opportunities is crucial for creating effective interventions based on the population. This is what we will continue focusing our efforts on in the near future.

Summary points

What was already known on the topic

- Access to reliable and quality health information and appropriate medical advice can contribute to a dramatic reduction in the mortality figures of countries.
- Internet penetration in the Spanish-speaking Latin American and Caribbean countries is 43.41%.
- Eight of the 10 health-related consultations were started through search engines like Google, Yahoo or Bing.

What this study added to our knowledge

- The probability of finding information of national health authorities on the 10 leading causes of death in a country, among the top 10 results on Google, is 6.66%.
- Ten out the 18 countries under study (55%) do not have information ranked among the top results in Google when searching for the selected terms.
- Wikipedia is one of the sources of information with the highest visibility when looking for information on leading causes of death, based on the selected search strategies, and constitutes a source of information for all the countries in which the search strategies were launched. The National Library of Medicine also got the same results.

Conflicts of interest

The authors declare that they have no competing interests.

Authors' contributions

David Novillo-Ortiz, Tony Hernandez-Perez and Francesc Saigí-Rubió contributed equally to this study.

Disclaimer

David Novillo-Ortiz is a staff member of the Pan American Health Organization/World Health Organization (PAHO/WHO) and is himself alone responsible for the views expressed in the paper, which do not necessarily represent the views, decisions, or policies of the PAHO/WHO.

Acknowledgment

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.ijmedinf.2017.01.013.

References

[1] M. D'Agostino, N. Al-Shorbaji, P. Abbott, T. Bernardo, K. Ho, C. Sinha, D. Novillo-Ortiz, eHealth initiatives to transform health in the Region of the Americas, Rev. Panam Salud Publica 35 (5/6) (2014) 326–328.

[2] World Health Organization, The Top 10 Causes of Death, 2017, http://www.who.int/mediacentre/factsheets/fs310/en/ (Accessed 14 October 2016).

[3] R. Campbell, Consumer health, patient education, and the Internet, Internet J. Health 2 (2) (2001) 001–008.

[4] G. Eysenbach, Medicine 2.0: social networking, collaboration, participation, apomediation, and openness, J. Med. Internet Res. 10 (3) (2008) e22.

[5] G. Kreps, L. Neuhauser, New directions in eHealth communication: opportunities and challenges, Patient Educ. Couns. 78 (3) (2010) 329–336.

[6] Y. Lee, J. Lin, Do patient autonomy preferences matter? Linking patient-centered care to patient-physician relationships and health outcomes, Soc. Sci. Med. 71 (November (10)) (2010) 1811–1818.

[7] D. Veroff, A. Marr, D. Wennberg, Enhanced support for shared decision making reduced costs of care for patients with preference-sensitive conditions, Health Aff. (Millwood) 32 (2) (2013) 285–293.

[8] K. Bertakis, R. Azari, Patient-centered care is associated with decreased health care utilization, J. Am. Board Fam. Med. 24 (3) (2011) 229–239.

[9] F. Greaves, U. Pape, D. King, A. Darzi, A. Majeed, R. Wachter, et al., Associations between Internet-based patient ratings and conventional surveys of patient experience in the English NHS: an observational study, BMJ Qual. Saf. 21 (July (7)) (2012) 600–605.

[10] X. Hu, R.A. Bell, R.L. Kravitz, S. Orrange, The prepared patient: information seeking of online support group members before their medical appointments, J. Health Commun. 17 (8) (2012) 960–978.

[11] G. Gao, J. McCullough, R. Agarwal, A. Jha, A changing landscape of physician quality reporting: analysis of patients' online ratings of their physicians over a 5-year period, J. Med. Internet Res. 14 (1) (2012) e38.

[12] S.M. Kelders, J.E. van Gemert-Pijnen, A. Werkman, E.R. Seydel, Evaluation of a web-based lifestyle coach designed to maintain a healthy bodyweight, J. Telemed. Telecare 16 (1) (2010) 3–7.

[13] F. Verhoeven, K. Tanja-Dijkstra, N. Nijland, G. Eysenbach, J.E. van Gemert-Pijnen, Asynchronous and synchronous teleconsultation for diabetes care: a systematic literature review, J. Diabetes Sci. Technol. 4 (May (3)) (2010) 666–684.

[14] International Telecommunication Union, Key 2005–2015 ICT Data for the World, by Geographic Regions and by Level of Development, for the Following Indicators [Internet], ITU, Geneva, 2015 (Available at: www.itu.int/en/ITU-D/Statistics/Documents/statistics/2015/ITU_Key_2005-2015_ICT_data.xls).

[15] G. Stephan, M.J. Hoyt, D.S. Storm, S. Shirima, C. Matiko, E. Matechi, Development and promotion of a national website to improve dissemination of information related to the prevention of mother-to-child HIV transmission (PMTCT) in Tanzania, BMC Public Health 15 (October (22)) (2015) 1077, http://dx.doi.org/10.1186/s12889-015-2422-x.

[16] E. Beckjord, L.J. Finney Rutten, L. Squiers, N. Arora, L. Volckmann, R. Moser, et al., Use of the internet to communicate with health care providers in the United States: estimates from the 2003 and 2005 Health Information National Trends Surveys (HINTS), J. Med. Internet Res. 9 (3) (2007) e20.

[17] E. Kontos, K. Emmons, E. Puleo, K. Viswanath, Communication inequalities and public health implications of adult social networking site use in the United States, J. Health Commun. 15 (Suppl. 3) (2010) 216–235.

[18] W.S. Chou, Y.M. Hunt, E.B. Beckjord, R.P. Moser, B.W. Hesse, Social media use in the United States: implications for health communication, J. Med. Internet Res. 11 (4) (2009) e48.

[19] E. Kontos, K.D. Blake, W.S. Chou, A. Prestin, Predictors of eHealth usage: insights on the digital divide from the Health Information National Trends Survey 2012, J. Med. Internet Res. 16 (7) (2014) e172.

[20] E. Hargittai, Digital na(t)ives? Variation in Internet skills and uses among members of the net generation, Sociol Inquiry 80 (1) (2010) 92–9113.

[21] E.Z. Kontos, K.M. Emmons, E. Puleo, K. Viswanath, Contribution of communication inequalities to disparities in human papillomavirus vaccine awareness and knowledge, Am. J. Public Health 102 (October (10)) (2012) 1911–1920.

[22] E.Z. Kontos, G.G. Bennett, K. Viswanath, Barriers and facilitators to home computer and internet use among urban novice computer users of low socioeconomic position, J. Med. Internet Res. 9 (4) (2007) e31.

[23] J. Wang, K. Bennett, J. Probst, Subdividing the digital divide: differences in internet access and use among rural residents with medical limitations, J. Med. Internet Res. 13 (1) (2011) e25.

[24] J. Torrent-Sellens, Á. Díaz-Chao, I. Soler-Ramos, F. Saigí-Rubió, Modelling and predicting eHealth usage in Europe: a multidimensional approach from an online survey of 13,000 European union internet users, J. Med. Internet Res. 18 (7) (2016) e188.

[25] M.L. Lustria, S. Smith, C. Hinnant, Exploring digital divides: an examination of eHealth technology use in health information seeking, communication and personal health information management in the USA, Health Inf. J. 17 (September (3)) (2011) 224–243.

[26] R. Thackeray, B.T. Crookston, J.H. West, Correlates of health-related social media use among adults, J. Med. Internet Res. 15 (1) (2013) e21.

[27] M.C. Gibbons, L. Fleisher, R.E. Slamon, S. Bass, V. Kandadai, J.R. Beck, Exploring the potential of Web 2. 0 to address health disparities, J. Health Commun. 1 (16 Suppl.) (2011) 77–89.

[28] L. Zach, P.W. Dalrymple, M.L. Rogers, H. Williver-Farr, Assessing internet access and use in a medically underserved population: implications for providing enhanced health information services, Health Info Libr. J. 29 (March (1)) (2012) 61–71.

[29] Descriptors in Health Sciences (DeCS). http://decs.bvs.br/E/homepagee.htm/. Accessed 14 October 2016.

[30] Google. http://www.google.com (Accessed 14 October 2016).

[31] comScore Releases February 2016 U.S. Desktop Search Engine Rankings. https://www.comscore.com/Insights/Rankings/comScore-Releases-February-2016-US-Desktop-Search-Engine-Rankings (Accessed 14 October 2016).

[32] Advanced Web Ranking (AWR). https://www.advancedwebranking.com/. (Accessed 14 October 2016).

[33] World Health Organization (WHO). http://www.who.int/. (Accessed 14 October 2016).

[34] Pan American Health Organization (PAHO). http://www.paho.org/. (Accessed 14 October 2016).

[35] Google Trends. https://www.google.com/trends/. (Accessed 14 October 2016).

[36] Advanced Web Ranking. Google Organic CTR Study 2014. Desktop Search Engine Rankings. https://www.advancedwebranking.com/google-ctr-study-2014.html. Accessed 26 December 2016.

[37] K. Viswanath, M.W. Kreuter, Health disparities, communication inequalities, and eHealth, Am. J. Prev. Med. 32 (May (Suppl. 5)) (2007) S131–S133.

[38] K. Viswanath, Public communications and its role in reducing and eliminating health disparities, in: G.E. Thomson, F. Mitchell, M.B. Williams (Eds.), Examining the Health Disparities Research Plan of the National Institutes of Health: Unfinished Business, The National Academies Press, Washington, DC, 2006, pp. 215–253.

[39] G. Eysenbach, C. Kohler, What is the prevalence of health-related searches on the World Wide Web? Qualitative and quantitative analysis of search engine queries on the internet, AMIA Annu. Symp. Proc. 2 (2003) 5–229.

[40] L. Baker, T.H. Wagner, S. Singer, M.K. Bundorf, Use of the Internet and e-mail for health care information: results from a national survey, JAMA 289 (May (18)) (2003) 2400–2406.

[41] B.W. Hesse, D.E. Nelson, G.L. Kreps, R.T. Croyle, N.K. Arora, B.K. Rimer, et al., Trust and sources of health information: the impact of the Internet and its implications for health care providers: findings from the first Health Information National Trends Survey, Arch. Intern. Med. 165 (22) (2005) 2618–2624.

[42] M.L. Ybarra, M. Suman, Help seeking behavior and the Internet: a national survey, Int. J. Med. Inf. 75 (January (1)) (2006) 29–41.

[43] E.B. Beckjord, L.J. Finney Rutten, L. Squiers, N.K. Arora, L. Volckmann, R.P. Moser, et al., Use of the internet to communicate with health care providers in the United States: estimates from the 2003 and 2005 Health Information National Trends Surveys (HINTS), J.Med. Internet Res. 9 (3) (2007) e20.

[44] S. Fox, M. Duggan, Pew Research Internet Project. 2013. Health Online 2013. http://www.pewinternet.org/files/old-media//Files/Reports/PIP_HealthOnline.pdf. Accessed 14 October 2016.

[45] P. Ramaswami, A Remedy for Your Health-related Questions: Health Info in the Knowledge Graph, 2016, Official Google Blog https://googleblog.blogspot.com/2015/02/health-info-knowledge-graph.html. (Accessed 14 2016).

[46] H. Tang, J.H. Ng, Googling for a diagnosis – use of Google as a diagnostic aid: internet based study, BMJ 333 (December (7579)) (2006) 1143–1145.