Digital strategies for dissemination to decision makers, of the results of the researchers in the public health field

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Outline of the paper

Abstract

Increased attention is being given to evidence-based policy-making encouraging researchers and policy-makers to communicate effectively with each other. Digital media are meant to facilitate the exchanges between both parties, but their availability and usage have not yet been examined in depth. Through an interdisciplinary approach, this article aims to provide taxonomy of digital media used by researchers and policy-makers to share knowledge within the specific field of public health. Within the framework of digital health communication, we describe classical web, web 2.0 as well as six other digital media (hypertext, images, videos, audio, infographics, and games) available for health researchers and policy-makers. Then, we discuss the risks and opportunities of online science outreach for health policy-making. Finally, we provide theory- and practice-based recommendations for researchers to circulate health-related research to policy-makers on the Internet.

Keywords

Digital health communication; Digital media; Knowledge exchange; Health policy-making; Health research; Science outreach.

Titre

Stratégies numériques de diffusion auprès des décideurs, des résultats des chercheurs en santé publique

Résumé

L'élaboration de politiques fondées sur des données probantes est un phénomène de plus en plus répandu qui encourage les chercheurs et les décideurs à communiquer efficacement entre eux. Les médias digitaux sont censés faciliter les échanges entre les deux acteurs, mais leur disponibilité et leur utilisation n'ont pas encore été examinées en détail. Avec une approche interdisciplinaire, cet article vise à fournir une taxonomie des médias digitaux utilisés par les chercheurs et les décideurs pour partager leurs connaissances dans le domaine spécifique de la santé publique. Dans le cadre de la digital health communication, nous décrivons le web classique, le web 2.0 ainsi que six autres médias digitaux (hypertexte, images, vidéos, audio, infographie et jeux) à disposition des chercheurs et des décideurs en santé. Ensuite, nous discutons des risques et des possibilités liés à la vulgarisation scientifique en ligne pour l'élaboration des politiques de santé. Enfin, nous formulons des recommandations fondées sur la théorie et sur la pratique destinées aux chercheurs afin qu'ils diffusent au mieux les résultats de leurs recherches sur la santé aux décideurs *via* Internet.

Mots clés

Communication numérique en santé ; Médias digitaux ; Echange des connaissances ; Elaboration des politiques de santé ; Recherche en santé ; Vulgarisation scientifique.

Título

Estrategias digitales para la difusión a los tomadores de decisiones, de resultados de investigadores de salud pública

Resumen

El interés creciente en torno a la formulación de políticas públicas basadas en la evidencia alienta a investigadores y responsables políticos a comunicarse eficazmente entre sí. Los medios digitales están destinados a facilitar los intercambios entre ambas partes, pero su disponibilidad y uso aún no han sido examinados en profundidad. A través de un enfoque interdisciplinario, este artículo pretende proporcionar una taxonomía de los medios digitales utilizados por investigadores y responsables políticos para compartir conocimientos en el campo específico de la salud pública. Partiendo dl marco de la comunicación digital de la salud, describimos la web clásica, la web 2.0, así como otros seis medios digitales (hipertexto, imágenes, vídeos, audio, infografía y juegos) a disposición de los investigadores en salud y de los responsables políticos. A continuación discutimos los riesgos y oportunidades de la divulgación científica en línea para la formulación de políticas de salud. Por último, ofrecemos recomendaciones basadas en la teoría y la práctica para que los investigadores puedan hacer llegar la investigación en salud a los responsables políticos a través de Internet.

Palabras clave

Comunicación en salud digital; Medios de comunicación digitales; Intercambio de conocimiento; Elaboración de políticas en salud; Investigación en salud; Divulgación científica.

Introduction

The use of research results for policy-making has received much research attention in the last decades (Almeida & Báscolo, 2006). It is gaining even greater importance today with the revolution brought by rapid progress in information and communications technology (ICT) (Borrego, 2017). This has affected the production, evaluation, and dissemination of research data. In particular, the Internet and social media are providing opportunities for researchers willing to disseminate their research results, which may have a significant impact on policy decisions.

Online science outreach (Bik *et al.*, 2015) and digital advocacy (Bürger, 2015) are crucial aspects of being a scientist nowadays. Publishing in electronic journals or posting on Twitter the updates of one's research activities can improve the dissemination of evidence in general and the engagement with policy-makers in particular (Kapp *et al.*, 2015). With the increasing emphasis on the need for evidence-based policy (Boaz *et al.*, 2008; Sanderson, 2002), researchers are often requested to provide reliable data to policy-makers thus contributing to the agenda-setting processes (Chubb & Reed, 2018). However, scientific evidence does not constitute per se an argument for policy-making: it is interpreted and used according to the political and social context (Kreps *et al.*, 2003). Not only do policy-makers seek correct information guiding them in their policy choices, but they are also eager to find arguments for what they emphasize as political "priorities". Research represents then a fantastic "reservoir of knowledge" for political strategies (Hanney *et al.*, 2003). In return, the visibility acquired by researchers at the political level can increase the chance of getting funding for their projects (Mirowski & Sent, 2008). Both parties must communicate and cooperate to benefit from this interaction and transform scientific results into societal, economic and political values (Anastopoulou, 2010).

Nevertheless, establishing effective communication links between researchers and policy-makers can be complex. Several guidelines exist (e.g., the European Union Scientific evidence for policymaking, 2008) to facilitate the transfer of knowledge and experience between research and policy-making. These guidelines usually invite researchers to conceive and deploy a precise dissemination strategy, including the organisation of briefing sessions and conferences, the production of promotional flyers and brochures, the writing of a clear final report and accessible policy-briefs, *etc.* Policy-makers can then rely on a wide range of resources to support their decisions and justify their choices.

The digital environment provides unprecedented access to research data and information. However, it can be challenging for policy-makers to search and select good quality data given the enormous volume of information available to them on the Internet. More recent studies on the role of ICT in science outreach have explored how scientists use online platforms and media tools to convey their research results to the general public (Erdt *et al.*, 2017; Bik *et al.*, 2015). However, the effects of media interventions, particularly social media, on policy-making processes are still understudied (Bou-Karroum *et al.*, 2017).

Since academic social networking sites and online scholarly journals – with the attached problem of predatory open-access publishing (Kearney, 2015) – are proliferating, and since policy-makers are increasingly using social media to keep updated with "live" scientific discoveries, it is essential to provide a structured mapping or taxonomy of existing digital media employed to disseminate research for policy-making.

This contribution is aimed to provide an interdisciplinary taxonomy of digital media for information exchange between researchers and policy-makers within the specific field of public health. This taxonomy allows (1) identifying and classifying the different digital media for science outreach (from classic web to podcasts); (2) understanding how these

media are changing the norms and styles of scientific information; (3) informing both researchers and policy-makers about their advantages and disadvantages; and (4) nourishing the discussion about the role and scope of action of researchers in the dissemination of their work to policy-makers through digital media. In light of these objectives, our work contributes to the 3rd axis of this special issue on scientific information since we present a broad picture of the digital strategies and practices of researchers in creating, evaluating and disseminating research results, with a focus on both digital risks and opportunities.

As an illustrative example of the role played by researchers on the media outreach of scientific information in the digital environment, we chose to consider the public health domain since the health research community has established high value to society by providing important information about disease trends and risk factors, outcomes of treatment or public health interventions, and health care costs and use (Gostin *et al.*, 2009). Furthermore, as emphasized by the World Health Organization (Hanney *et al.*, 2003), attention is increasingly focusing on the importance of policy-making in achieving effective health systems. Nonetheless, while being specific to public health, we hypothesize that our work could be of interest for researchers of other domains and that identified digital media might not vary across different sciences.

Definition of digital health communication

The complex interplay between digital media, public health, and politics needs to be framed in the context of an emerging trans-discipline, digital health communication (Roberts *et al.*, 2017), whose definitions are sparse and fragmented. Based on the definition of health communication in general provided by Schiavo[1] (2013), we propose that digital health communication is conceptualized as the creation and use of digital technologies to exchange health messages and data among individuals, organizations, and communities to increase awareness, inform decisions, influence behaviors, and improve outcomes in the health domain. Digital health communication can be understood as a sub-field of health communication whose unique aspect is the utilization of digital media as vectors of health information (Nanah & Bayoumi, 2018). Examples of digital health communication range from sharing electronic health records, telehealth applications, Internet and mobile health applications, and all other related information technologies. The underpinning intention of digital health communication is to make health information more accessible, balancing the need for simplification to drive use and understanding with the ethical imperatives of accuracy and fairness by applying the right strategies and tools to disseminate information (Park *et al.*, 2017).

Methods: an interdisciplinary taxonomic approach

Three authors of this paper embodied all disciplines of digital health communication (web science for digital, public health for health and communication sciences for communication) and a fourth author was specialized in political sciences and policy-making. In addition, authors came from four different countries (France, Germany, Italy and United Kingdom) thus composing an interdisciplinary international working team.

In order to produce a taxonomy of digital media for health policy-making, the four authors proceeded with (1) a mapping of existing online resources for sharing scientific information, and (2) a process of theoretical thinking provided by a scoping review. The mapping consisted in listing and describing in a few lines digital media employed or known by each author, while the literature review was inspired by the guidelines of the PRISMA extension for scoping reviews (PRISMA-ScR) (Tricco *et al.*, 2018). Both the mapping and the scoping

literature review were conducted independently by each author. The first author was in charge of collecting and collating the text documents resuming the results of the work of her colleagues. Once the results had been synthetized, the four authors engaged in face-to-face meetings, conference calls, and e-mail exchanges to discuss on the final list of digital media informed by the results of the literature review. After twelve months of collaborative working, a first taxonomy was produced in 2016 and revised at the end of 2018. Following the methodology proposed by Reyna *et al.* (2017), digital media were mapped, listed and classified in eight groups (taxons) composed by media with similar objectives and functioning.

Results and Analysis

Online science outreach: from classic web to online games

The scoping review highlighted the heterogeneity of studies on digital media for the transfer of health information for policy-making, as well as the lack of a comprehensive study conceptualizing and classifying these media. Existing research in this area has started in countries like the United States, Canada, and Australia, while European health researchers seem less involved in this subject (Hannawa *et al.*, 2012). In Australia, for instance, an online tool was developed to help policymakers better engage with research (Makkar *et al.*, 2015). Based on the structured mapping and the scoping review, we finally identified the following eight taxons: classical web and web 2.0 as the two main digital delivery methods available for health researchers and policy-makers, plus hypertext, images, videos, audio, infographics, and games. Table 1 illustrates the taxons by synthetizing their main features according to the results of both the mapping and the process of the four authors' theoretical thinking based on the scoping review.

Table 1. Principal features of the eight taxons/digital media for health policy-making.

Taxon	Type(s) of information circulated	Communication process	Sender/Receiver relationship	Motivation(s)/Aim(s)
Classic web	Official/institutional information (research results)	One-way	Downward	Giving credibility to research work; disseminating evidence-based results
Web 2.0	Information on ongoing research (protocol, methods, preliminary results)	Two-way	Interactive, peer to peer, horizontal	Communicating about ongoing research; raising interest in specific results; facilitating interactions and engagement between researchers and policy-makers
Hypertext	Information on research (protocol, methods, results)	One-way	Interactive, but downward	Providing more complete information than simple text
Images	Instantaneous information on results	One-way	Downward	Making information visible, immediate and concrete; leveraging emotions
Videos	Information on research (protocol, methods, results)	One-way	Downward	Summarizing complex information through a story-telling approach
Audio	Information on research (protocol, methods, results)	One-way (ex. podcasts) Two-way (ex. Skype)	Downward or Horizontal	Turning scientific knowledge into mainstream information
Infographics	Information on results	One-way	Interactive but downward	Providing clearer and more intuitive information
Games	Information on methods and results	Two-way	Interactive, multidirectional	Making information appealing; enhancing its comprehension; leveraging emotions

Classic Web

The term "classic Web" mainly refers to one-way information provided through websites like online scientific journals (either open- or paid-access), official websites of research institutions/studies, official websites of national scientific and government authorities, online newspapers and magazines, and other publicly available health-related websites. Traditionally, health research results are diffused through the scientific press, and health researchers are interested in publishing in recognized journals, to give their work credibility (Hirsch, 2005). Online scientific journals are often the first place where health researchers publish the results of their work, and policy-makers consider them one of the most important sources of information to support their decisions. However, the recent phenomenon of predatory journals is threatening and corrupting the communication of science (Clark & Smith, 2015).

Other web-based documentary sources of information for policy-makers are working papers, evaluations, briefings and reports which are available on websites of research institutions, and of national scientific and government authorities (Innvaer *et al.*, 2002).

Online newspapers and magazines, as well as other publicly available health-related websites, can play an important role in alerting policy-makers to the publication of new research. Online mass media may not define the nature or direction of policy change but can undoubtedly steer attention towards certain policy domains over others (Soroka *et al.*, 2012).

Web 2.0

The websites discussed thus far are mainly static, apart from comments left by readers on newspaper websites and articles in some online scientific journals. The principle of Web 2.0 is to allow for interaction between people using the web. The most popular digital tools from Web 2.0 are: social networks, wikis, blogs, vlogs (video blogs), and forums. These tools can facilitate direct interactions and engagement between researchers and policy-makers (Haynes *et al.*, 2012).

The advent of Web 2.0 has also allowed health researchers to communicate their work in other forms alongside official scientific publications. Expressing their opinions and exchanging information on social networks or forums is a way for health researchers to discuss their ideas about ongoing research. What policy-makers can find in the Web 2.0 cannot be found elsewhere: current projects, ongoing scientific reflections, existing research networks *etc.*

Social networks, e.g., Twitter or Facebook, allow researchers and policy-makers to interact with the online community to identify research needs, knowledge gaps and areas of public interest. The social media-politics dynamic and its influence on public discussions of health is an area which has received significant research attention, specifically to ascertain how the representation of health and use of social media technology impact public conceptualization and enactment of health, healthcare and health policies (Donelle & Booth, 2012).

Academic, social networking sites like ResearchGate or Academia.eu are increasingly used by researchers (Borrego, 2017). While their scope is mostly to promote exchanges among scholars, they might constitute a reliable source of information for policy-makers, provided that they are registered users.

Another tool used to share health research information are wikis: websites that can be edited by anyone who has access to them (Boulos *et al.*, 2006). Easy to use and consult, wikis offer much powerful information sharing and collaboration features to health re-

searchers, but information is potentially authored by non-experts. Policy-makers using wikis may not be sure of the quality of information provided.

A recent practice diffused among health researchers is the creation of personal, academic blogs or vlogs. Especially in the case of eminent famous researchers, these digital tools can be a source of information for policy-makers to understand the opinions and motivations of researchers, as well as their ongoing work.

Finally, forums allow themed discussions on health topics with different actors including researchers and policy-makers. A particular well-known example is Reddit (www.reddit.com) on which renowned researchers answer questions about their work.

Hypertext

Linear, plain text is the first basic medium employed to transfer knowledge *via* both classic Web and Web 2.0. Very early in the development of the Internet it became clear that digital text allows several advantages over traditional printed text. Digital text preserves identifiable markers of linguistic cues (letters, words, and grammar), and also features new elements allowing for more interaction. For instance, digital text can be enriched by hyperlinks pointing to other webpages, thus becoming a "hypertext." Sometimes, digital text is a more complex combination of plain text, images, videos and audio files (Beach & Castek, 2016).

Images

Images (e.g., photos, maps or diagrams) make information visible and concrete and appeal directly on an emotional level (Black *et al.*, 2017). Photos are usually a good source of instantaneous information: they can be rapidly viewed and convey immediate impressions to policy-makers. Maps allow the presentation of spatial information. Finally, diagrams can illustrate more complex information (numbers, data) in quickly accessible screenshots. Traditionally, images have been static but in the digital environment can be interactive. For instance, a simple click allows users to control a map and move within it creating tailored pathways. Animated GIFs (Graphics Interchange Format) can quickly transmit simple motion sequences conveying a concise message.

Videos

Videos serve as visual embodiments of issues or situations, condensing complex problems into a narrative structure. Some executive summary videos are available online for policy-makers: they explain the core topics policy-makers need to be aware of to establish new evidence-based policies. Videos about health researchers, how they work, and the results of their research programs can quickly and efficiently inform policy-makers of advances in health research.

Audio

Today the Internet is being used to access several sources of audio, such as radio programs in real-time listening (audio streaming), recorded files such as podcasts which can be transmitted over the Internet and listened to later (downloading), and direct audio exchanges *via* telephone networking (Skype or similar voice over IP telephony services). Especially podcasting is largely used to inform policy-makers on sensitive issues.

Infographics

Infographics are combinations of text, images, charts, and other visual elements. They can be used to summarize research in a way more suited to distribution *via* social media. Some infographics employ data visualization techniques – representing numerical quantities

with visual elements such as position, shape, size, *etc.* They can be static, animated (video) or interactive. Infographics have become more popular as the world becomes more data rich and time poor.

Software tools and websites for making visualizations are becoming more widespread. Visualization is an excellent way to get a quick overview of complex, multidimensional data.

Games

The use of computer games to disseminate research has not been widely explored. This may be in part because of the size of the budget required for even quite simple game projects. However, some simple games have been used for educational outreach, often in collaboration with museums and other public institutions.

For example, the RIZK game (http://whoami.sciencemuseum.org.uk/online_science/games/rizk) was designed in collaboration with the London Science Museum to explain the concepts of likelihood and severity of risks, in relation to climate change. The Wellcome trust (www.wellcome.ac.uk) has also funded a number of games which explore health-related issues.

Other digital tools

We did not consider digital technologies like Google Drive or DropBox as digital media but as share resources implying a pre-existing collaboration between parties. This might be the case also of newsletters addressed to institutions which are already in contact. Similarly, devices, software/applications, and programming/coding were excluded from our taxonomy since they are digital working tools whose aim is not specifically the dissemination of information. Finally, augmented reality, 3D photography and video, optical display (Google Glasses *etc.*) and personal bio measurements (smart watches *etc.*) are also impacting the digital communication field at the moment. All these digital technologies and tools can indirectly help to conceive and build messages to be delivered through digital media.

Risks and opportunities of digital health communication for the transfer of knowledge

Digital media have an essential role in connecting, sharing information, and learning, but they also have controversial aspects. In this section, we list the risks, the opportunities and the elements which can be considered as both advantages and disadvantages (ambiguous factors) in digital health communication. The latter category is of particular relevance, since it is hard and probably naïve to make a binary classification of digital media attributes and effects. Thus, the intent of this section is to present both bright and dark sides of digital health communication so as to nourish the discussion on how the digital environment is deeply affecting the way health research information is produced, evaluated and disseminated.

Risks

Evaluating the quality of health information online can be challenging. As the number of potential access points and information providers has multiplied, it has become increasingly difficult to get a clear picture of exactly how policy workers find and access information (Grayson, 2007).

On the other hand, researchers themselves may publish research online without adequate bibliographic information or scientific soundness, thus reducing the credibility of their work. Following the Diffusion of Innovations (DOI) theory (Rogers, 2010), health resear-

chers have primary responsibility for the transfer of outcomes of their research to assist health policy-making. The danger of bias is real.

This bias might also be exacerbated by the so called Matthew Effect (Merton, 1968) according to which information provided by well-known researchers or researchers from institutions of high reputation would be given more credit than information from other sources. The digital media might emphasize the Matthew Effect in science by giving even more visibility on the web to contributions from researchers of high rank. This to the detriment of the work by other less prestigious and younger scientists, whose blogs or ResearchGate pages are likely to be rarely if ever consulted.

Another risk is the presence of possible inequalities because only richer people have access to fast computers and connections and have better literacy levels. The information policy-makers can find on the Internet is mostly produced by the richest (Van Deursen & Van Dijk, 2014).

Finally, the very ease of access to multiple sources of information might be a danger. More challenging formats like scientific journals might be neglected in favour of more superficial messages. In that way, immediately available information could create intellectual laziness.

Opportunities

A significant strength of digital health communication is its live updating to the most current content. Policy-makers need information which corresponds to real-time discoveries. Web-content can be accessed instantly and delivered through a range of systems such as mobile apps, websites, and other devices. This makes information available for policy-makers wherever they are. Increasingly, they do not need to look for information, because it is coming straight to them.

Furthermore, online publication is supposed to be cheap and easy. As a result, the production of different digital resources has been growing exponentially since the development of the Internet. The rapid increase in the diffusion of non-commercial, non-scholarly publications (grey literature) is an example of this phenomenon.

Opportunities for two-way communication afforded by digital technology can also result in a better understanding of health research results. Policy-makers can interact directly with researchers and better understand data by sending an email or answering to a tweet.

Ambiguous factors

Digital media provide the chance to transfer the same information through several channels, reinforcing one's message. Policy-makers might pay more attention to scientific results that are making a "buzz" among the general public. However, greater popularity does not mean greater evidence that the detected problem should objectively be a public health priority. Some issues are over-covered and commented by the media while others are not, which does not imply that the former are objectively more important to solve.

Furthermore, Web 2.0 allows direct communication between researchers and policy-makers without the "filters" of traditional scientific media (e.g., peer-reviewers for scientific journals, journalists for printed press, interviewers for radio and television). This non-filtered communication is supposed to avoid any possible distortion of the research results due to a misunderstanding of the subject (Gonon *et al.*, 2011). Direct communication should bridge any gap between scientific findings and politics. However, this could give health researchers the possibility to distort their results or to emphasize the most eye-catching outcomes of their research, whether intentionally or not (Fanelli, 2009). Also,

policy-makers may not have the specialist knowledge to assess the validity of findings directly provided by health researchers with no intermediaries.

Also, policy makers, like many users of social media, may increasingly be exposed to information depending on who they are connected with, leading to an "echo chamber" of similar views. Politicians like the US president Donald Trump are using social networks to directly disseminate their opinions and decisions to the public, without the filtering lens of the media.

Finally, push notifications are great time savers, but can lead to silos and echo chambers as well (Sanfilippo & Lev-Aretz, 2017). Receiving notifications from pre-selected sources might contribute to a real media bias where users tend to select information that adheres to their system of beliefs (Bessi, 2016).

Conclusion: theory -and practice- based recommendations

The taxonomy we proposed is meant to help researchers and policy-makers to understand the different functions and purposes of use of available digital media for health policy-making. While being quite familiar with traditional communication channels, e.g., scientific publications, reports, and policy briefs, health researchers and policy-makers are currently facing the challenges of digital media which, as described above, present both risks and opportunities (Bik *et al.*, 2015). Within the theoretical framework of digital health communication, the four authors of this paper together identified digital media from their disciplinary perspective and their personal experience as users. After frequent discussions and interactions (e.g., organization of joint workshops on digital health communication) based on the results of the taxonomy and of the scoping review, the authors formulated three core recommendations for conducting effective online outreach for health policy-making. We suggest to read these recommendations by looking at Table 1 above which facilitates their understanding and practical application. Last but not least, these recommendations are especially addressed to young researchers who are entering the competitive world of science as a system of communication where they need to find their own place and stabilise their role (Merton, 1968).

Include digital media interventions in your research dissemination if you wish to initiate policy discussion

It is important that researchers familiarise themselves with digital media and integrate them in their professional activities. Online science outreach must be conceived as a core part of the research process. Undeniably, scientists are asked to systematically and continuously show their research activity on social media and the Web to inform their audience (Erdt, 2017). However, they might be reluctant or unable to invest much time and energy in outreach activities. It may be that research institutions need to work with communications professionals to effectively engage with online communities. A systematic review on planned media interventions on the health policy-making process (Bou-Karroum *et al.*, 2017), has demonstrated the importance of the use of digital media as tools capable of increasing policymakers' awareness, influencing policy formulation, promoting awareness leading to policy adoption, as well as awareness to improve compliance with laws and regulations. Furthermore, the current trends in the diffusion of misinformation on social media (so-called "fake news") call for stronger presence of researchers' voices on the Internet, as guarantors of evidence-based data. Health researchers have a leading role in guaranteeing the publication of valuable health information and have a responsibility to communicate their research: digital media can accelerate this process.

Get digital media training

The dissemination of science information has recently entered a new age demanding preparedness and skills to use the Internet and social media (McClain, 2017). Health researchers and policy-makers should receive better training on how to use appropriately and effectively available digital media, or to more effectively work with communications professionals. On the one hand, transfer of health research results would be more successful if health researchers were trained to make work available in formats and styles applicable to policy audiences (specific editorial norms, fragmented and short writing, preference for visual information, *etc.*). On the other hand, policy-makers should be trained to use effectively digital media for getting the information they need. Including communication courses among the core subjects that early career researchers and politics students are expected to take should be a priority in educational programs.

Develop a multidisciplinary thinking

It only makes sense to apply recommendations 1 and 2 if researchers and policy-makers are « multidisciplinary thinkers » first (Kline, 1990). In today's technologically sophisticated societies, complex problems can be solved by a coordinated effort that brings together several disciplines (Cuevas *et al.*, 2012). While multitasking has become a must-have skill (researchers are required to be project and human resource managers, whereas policy-makers are asked to be data analysers and communicators), it is important to preserve the specificity of each profession. Researchers, in particular, are facing the paradox of being as open and multidisciplinary as possible, even though they have to focus their research activities on a precise and unique subject. However, to communicate research results effectively, researchers and policy-makers are not expected to be avid scholars in several disciplines or to be communication experts. They do not have to be "multidisciplinary professionals," but have to be open for collaboration and need to be "multidisciplinary thinkers," i.e., they must have the capacity to call upon other experts from other fields and collaborate with them. In practice, it is recommended that health researchers and policy-makers work more often with those specifically trained in web-based disciplines such as communication design, film, and video design, *etc.*, to best use digital media. Some agencies and freelancers are available to help scientists improving their science communication (building scientific websites, making scientific illustrations and animations, producing social media campaigns). Whenever possible, forming partnerships with communication experts may facilitate the online science outreach process.

In the end, it is important to take in to account the evolving nature of digital health communication since new media, tools, and approaches will likely emerge exponentially. The proposed taxonomy and attached recommendations are required to be updated continuously with information on most and least used taxons, circulated information, shared data and so on. Quantitative and qualitative surveys addressed to researchers and policy-makers are needed to provide additional insight into the current and future state of digital health communication.

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