

Digital tools, multidisciplinary and innovation for communicating vaccine safety in the COVID-19 era

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ABSTRACT

The research on the anti-SARS-CoV-2 vaccines and their commercialization is an opportunity to test and consolidate the current knowledge along with the diverse available tools related to vaccine communication.

In this paper we explore the value of a multidisciplinary approach in this field: vaccine communication activities can be combined with insights from data science, risk communication, behavior change, design thinking and digital marketing. Methodologies derived from innovation and human-centered design can contribute to the development and testing of vaccine promotion campaigns, speeding up processes and streamlining the production of evidence in this area. The multiple activities involving the anti-SARS-CoV-2 vaccine could be the fertile ground in which to develop, test and refine effective frameworks to transfer data acquired through listening strategies into effective vaccine promotion campaigns. The World Health Organization's Vaccine Safety Net is an interesting example of trusted information sources that aim toward using digital tools and innovative methodologies for communicating science-based information on vaccine safety at the global level.

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Public acceptance and confidence in the future anti-SARS-CoV-2 vaccines should not be taken for granted.¹

A number of factors may fuel hesitancy toward the anti-SARS-CoV-2 vaccines. The “race” to develop a vaccine has raised important questions regarding vaccine safety and efficacy. Concerns about the possible lack of transparency in vaccine development processes, particularly in regards to safety study designs, are circulating. The waning public trust in governments and authorities, particularly in countries where lockdown and masking policies are enforced, might undermine vaccine uptake. Conspiracy theories on the objective of public health COVID-19 vaccination programs are already circulating² and online bots might pose a serious threat to the health of different populations through the spread of fake news.³

To counter vaccine hesitancy, complex action is required by public health authorities which takes into account different dimensions, such as international and national policies, recommendations and guidelines, the role of primary care providers, equitable access to vaccines, community engagement with leaders and influencers, the level of trust in governments and their institutions to protect citizens from harm (both from diseases and the potential adverse events associated with the introduction of new vaccines) and, last but not least, the delivery of timely, effective, transparent and data-driven communication on vaccines.

One crucial characteristic of health communication in the COVID-19 era is the overabundance of information – the so-

called “infodemic”⁴ – which the World Health Organization (WHO) has identified as a risk to people's physical and mental health. At the same time, the digital world is a context in which a large variety of tools and opportunities may come into play for health promotion and, more specifically, for improving vaccine confidence and uptake.

The COVID-19 pandemic offers an unprecedented opportunity to marry purposeful communication learning and approaches with scientific evidence, thereby bringing vaccination communication to a new level of complexity and achievement.

Here we outline some of the more promising approaches and available technologies that should be considered for integration, where possible, with communication activities by local public health authorities.

1. Vaccine communication, multidisciplinary and digital tools

Communication in the vaccine field can avail itself of the support from numerous disciplines, which have, in recent years, explored different viewpoints on the complex subject of vaccine communication.

Data science, internet studies and digital technologies, through machine learning, natural language processing and other AI-based techniques, have allowed us to progressively refine the techniques for listening to web conversations, thus providing us with tools to:

(a) assess public confidence in vaccines, through the automated description of some of the characteristics of the vaccine discourse on social media (albeit with a margin of error which must be kept in mind and which prompts the human interpretation and use of these data) and through describing and profiling the communities involved in the conversations;^{5,6} (b) tracking fake news, by analyzing and predicting the dynamics of information, misinformation and disinformation on the web.⁷

Risk communication offers a methodology for assessing the risk perception of vaccines and proposes a multifaceted approach to communication management and building trust in immunization programs.⁸

Behavior change offers models for improving public health behaviors and outcomes over time.⁹

Design thinking^{10,11} is a popular strategy for matching user needs (in vaccine communication, information needs, doubts and misconceptions) with appropriate solutions.

Digital marketing allows the audience to be studied and segmented to support the development of targeted communication campaigns.

2. Vaccine communication and innovation

Scientific research in communication has a broad scope and is pivotal to selecting the right strategies to use in different circumstances. However, the usual research methods which start from a hypothesis that should be confirmed or refuted may benefit from the integration with the practical experiments and development processes used in innovation and in human-centered design.¹²

The innovation aims to discover new values or products and uses an approach closer to engineering, in which a prototype is reviewed in cycles to find the product that best meets the final user needs. As communication in an emergency will obviously have a time constraint, and will have to continuously adapt to quick and frequent changes, communication products should be developed on a fast track. While traditional study designs will remain central for the development of communication strategies, only small experiments will be possible in a short time frame. These experiments should be continuously performed to refine communication strategies and adapt to possible changes that may rapidly happen in local settings depending on unpredictable circumstances.

In practice, an innovation process starts from the assessment of a need and often includes the final users in the development process. In the case of a vaccine communication strategy, the development process could be articulated in the following steps: listening to public concerns on vaccines; informing the content of the messages; cyclically monitoring the effectiveness of the campaigns and refining the communication strategies based on feedback and performance; and then measuring and evaluating outcomes.

Innovative tools can be used in each of the above-mentioned steps of the process: the listening and the evaluation phase could include traditional qualitative methods, innovative web and social media listening techniques;¹³ message creation can include the general public or specific population subgroups (e.g. patients or adolescents) in the process through the use of

a human-centered design approach and any step of the process can benefit from crowdsourced solutions.

3. How to frame a communication campaign based on listening data?

A crucial gap in vaccine communication research lies in the transition between audience data and the framing of vaccine communication interventions. Numerous studies, using surveys, focus groups, interviews and social media listening tools, have described doubts, misconceptions and other determinants of hesitancy in circulation, which can have an impact on vaccination acceptance.⁵ Fewer are the high-quality studies on the effectiveness of different types of digital communication in addressing determinants of hesitancy.¹⁴ The results of these kinds of studies are highly specific, and are limited by filtering parameters, such as geographical settings and the characteristics of target populations, which reduces their effectiveness and their generalizability. Using innovative methodologies could streamline the production of evidence in this area. Even fewer are the studies analyzing ways to use the knowledge acquired through listening methods for shaping effective communication campaigns.¹⁵

The COVID-19 pandemic and the promotion of the anti-SARS-CoV-2 vaccine can be an opportunity to structure and test frameworks that guide the use of social media listening data, focus groups, surveys, epidemiological data and vaccination coverage to create a communication campaign. A flexible and effective framework could also allow communication tools to be quickly adapted to different contexts and to different segments of the population.

Human-centered design could play a central role in the process of translation from listening data to the development of communication strategies.¹¹ The proposal and evaluation of different “toolboxes” that can guide this step could speed up processes and give a strong impetus toward the creation of evidence to support the vaccination communication.

4. Inoculating science-based information through trusted sources

Trust is one of the main determinants of vaccine confidence. A perfect message delivered in a context with a low level of trust in the institutions and in the scientific community will probably have limited success. At the same time, the circulation of misinformation and disinformation on the web and on social media can slowly erode trust in vaccines and in the health systems, triggering a perpetual cycle of vaccine hesitancy issues and ultimately to decrease vaccine coverage.¹⁶

Recovery from, and avoidance of, such a dangerous event is possible by “inoculating” the vaccine debate with sound, science-based, customized information by trusted sources of information.¹⁷

A timely example of how to inject sound messages from verifiable sources is the Vaccine Safety Net (VSN).¹⁸ VSN, established in 2003 by WHO, is a network of diverse websites from a range of low-to-high income countries that provide science-based information on vaccine safety in various languages. VSN candidates are evaluated based on the

good information practices criteria put forth by the Global Advisory Committee on Vaccine Safety, and membership is assigned based on credibility, content (quality and quantity), design and accessibility criteria. Since 2017, the Vaccine Safety Net, through the Web Analytics Project, is capitalizing on a wide range of new technologies to support vaccine communication. In the first phase of this project, the web analytics of the websites included in the network have been constantly monitored, offering participating members deep insights into the sociodemographic characteristics and behaviors of the users, along with a set of information on the public interest in vaccine-preventable diseases.¹⁹ Based on these data, guidelines to improve the websites' performances and their visibility on the Google search engine have been provided. The success of the web analytics project is a result of the collaborative nature of the VSN initiative and its members, who have voluntarily provided their websites' analytics data for the benefit of the project.

Recently, the Web Analytics Project 2.0 has been launched. VSN websites will be provided with insights on information, misinformation and disinformation on vaccines (in particular regarding the future vaccine against SARS-Cov-2), which are circulating on the web and on different social media platforms. Country and region-specific metrics will be available, as well as information on the communities involved in the vaccination discourse. This will help to detect signals when the vaccines will be launched and adjust communication accordingly. A framework for guiding the development of communication campaigns based on this data will also be developed by a research working group of experts and VSN members from different disciplines.

In conclusion, innovative communication strategies have groundbreaking potential for vaccine promotion. To express the highest impact of these strategies, communication should be closely intertwined with surveillance activities, to inform timely and effective public health actions. The experience gained in the promotion of the vaccine against COVID-19, thanks to the flexibility of the adopted methodology, could be replicated to improve the acceptance and uptake of other vaccines, including those already available and those that will be developed in the future.

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References

- Lazarus JV, Ratzan SC, Palayew A, Gostin LO, Larson HJ, Rabin K, Kimball S, El-Mohandes A. A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med.* 2020 Oct;20:1–4. doi:10.1038/s41591-020-1124-9.
- Bertin P, Nera K, Conspiracy Beliefs DS. Rejection of vaccination, and support for hydroxychloroquine: a conceptual replication-extension in the COVID-19 pandemic context. *Front Psychol.* 2020 Sep 18;11:565128. doi:10.3389/fpsyg.2020.565128.
- Broniatowski DA, Jamison AM, Qi S, Alkulaib L, Chen T, Benton A, Quinn SC, Dredze M. Weaponized health communication: twitter bots and Russian trolls amplify the vaccine debate. *Am J Public Health.* 2018 Oct;108(10):1378–84. doi:10.2105/AJPH.2018.304567.
- WHO, UN, UNICEF, UNDP, UNESCO, UNAIDS, ITU, UN Global Pulse, and IFRC. Managing the COVID-19 infodemic: promoting healthy behaviours and mitigating the harm from misinformation and disinformation; 2020 Sep 23 [accessed 2020 Nov 16]. <https://www.who.int/news/item/23-09-2020-managing-the-covid-19-infodemic-promoting-healthy-behaviours-and-mitigating-the-harm-from-misinformation-and-disinformation>
- European Centre for Disease Prevention and Control. Systematic scoping review on social media monitoring methods and interventions relating to vaccine hesitancy. Stockholm, Sweden: ECDC; 2020.
- Martin S, Kilich E, Dada S, Kummervold PE, Denny C, Paterson P, Larson HJ. Vaccines for pregnant women ... ?! Absurd? - Mapping maternal vaccination discourse and stance on social media over six months. *Vaccine.* 2020 Sep 29;38(42):6627–37. doi:10.1016/j.vaccine.2020.07.072.
- Cinelli M, Quattrociocchi W, Galeazzi A, Valensise CM, Brugnoli E, Schmidt AL, Zola P, Zollo F, The SA. COVID-19 social media infodemic. *Sci Rep.* 2020 Oct 6;10(1):16598. doi:10.1038/s41598-020-73510-5.
- Bouder F. Risk communication of vaccines: challenges in the post-trust environment. *Curr Drug Saf.* 2015;10(1):9–15. doi:10.2174/157488631001150407103916. PMID: 25859669
- Corace KM, Srigley JA, Hargadon DP, Yu D, MacDonald TK, Fabrigar LR, Garber GE. Using behavior change frameworks to improve healthcare worker influenza vaccination rates: A systematic review. *Vaccine.* 2016 Jun 14;34(28):3235–42. doi:10.1016/j.vaccine.2016.04.071.
- Seeber L, Michl B, Rundblad G, Trusko B, Schnjakin M, Meinel C, Weinberg U, Gaedicke G, Rath B. A design thinking approach to effective vaccine safety communication. *Curr Drug Saf.* 2015;10(1):31–40. doi:10.2174/157488631001150407105400.
- on behalf of the Working Group on Reaching Populations for COVID-19 Vaccine, Schoch-Spana M, Brunson E, Long R, Ravi S, Ruth A, Trotochaud M, The public's role in COVID-19 vaccination: planning recommendations informed by design thinking and the social, behavioral, and communication sciences. Baltimore (MD): Johns Hopkins Center for Health Security; 2020.
- Topol EJ, Hill D. The creative destruction of medicine: how the digital revolution will create better health care. New York: Basic books; 2012.
- Luo X, Zimet G, Shah S. A natural language processing framework to analyse the opinions on HPV vaccination reflected in twitter over 10 years (2008-2017). *Hum Vaccin Immunother.* 2019;15(7--8):1496–504. doi:10.1080/21645515.2019.1627821.
- Ortiz RR, Smith A, Coyne-Beasley T. A systematic literature review to examine the potential for social media to impact HPV vaccine uptake and awareness, knowledge, and attitudes about HPV and HPV vaccination. *Hum Vaccin Immunother.* 2019;15(7–8):1465–75. doi:10.1080/21645515.2019.1581543.
- Bahri P, Fogd J, Morales D, Kurz X; ADVANCE consortium. Application of real-time global media monitoring and 'derived

- questions' for enhancing communication by regulatory bodies: the case of human papillomavirus vaccines. *BMC Med.* 2017 May 2;15(1):91.
16. Larson HJ Politics and public trust shape vaccine risk perceptions. *Nat Hum Behav.* 2018 May;2(5):316. doi:10.1038/s41562-018-0331-6. PMID: 30962595.
 17. Compton J, Jackson B, Dimmock JA. Persuading others to avoid persuasion: inoculation theory and resistant health attitudes. *Front Psychol.* 2016 Feb 9;7:122. doi:10.3389/fpsyg.2016.00122. PMID: 26903925; PMCID: PMC4746429.
 18. World Health Organization. Weekly epidemiological record Relevé épidémiologique hebdomadaire. Global Advisory Committee on Vaccine Safety; 2016 November 30–December 1. World Health Organization; 2017. N. 2, 2017, 92, 13–20.
 19. Gesualdo F, Marino F, Mantero J, Spadoni A, Sambucini L, Quaglia G, Rizzo C, Sahinovic I, Zuber PLF, Tozzi AE. VSN-WAP study group. The use of web analytics combined with other data streams for tailoring online vaccine safety information at global level: the vaccine safety net's web analytics project. *Vaccine.* 2020 Sep 22;38(41):6418–26. doi:10.1016/j.vaccine.2020.07.070.