Routledge
Taylor & Francis Group

Journal of Applied Communication Research

ISSN: 0090-9882 (Print) 1479-5752 (Online) Journal homepage: https://www.tandfonline.com/loi/rjac20

Applying the communication theory of Diffusion of Innovations to economic sciences: a response to the '*Using gossips to spread information*' experiments conducted by the 2019 Nobel Laureates

Do Kyun D. Kim, Kerk K. Kee & James W. Dearing

To cite this article: Do Kyun D. Kim, Kerk K. Kee & James W. Dearing (2020): Applying the communication theory of Diffusion of Innovations to economic sciences: a response to the '*Using gossips to spread information*' experiments conducted by the 2019 Nobel Laureates, Journal of Applied Communication Research, DOI: 10.1080/00909882.2020.1734226

To link to this article: https://doi.org/10.1080/00909882.2020.1734226

Published online: 26 Mar 2020.

JOURNAL OF APPLIED COMMUNICATION RESEARCH
https://doi.org/10.1080/00909882.2020.1734226

INVITED ARTICLE

Applying the communication theory of Diffusion of Innovations to economic sciences: a response to the '*Using gossips to spread information*' experiments conducted by the 2019 Nobel Laureates

Do Kyun D. Kim[a], Kerk K. Kee[b] and James W. Dearing[c]

[a]Communication, University of Louisiana at Lafayette, Lafayette, LA, USA; [b]Media & Communication, Texas Tech University, Lubbock, TX, USA; [c]Communication, Michigan State University, East Lansing, MI, USA

ABSTRACT

Drs Abhijit Banergee, Esther Duflo, and Michael Kremer won the 2019 Nobel Prize in Economic Sciences for their remarkable series of large-scale field experiments to lessen global poverty. The main theoretical framework that they employed was the diffusion of innovations research and practice paradigm (DOI) which has had a long presence in communication research dating back to the 1940s. Here, we reviewed the Nobel laureates' article, 'Using gossips to spread information: Theory and evidence from two randomized controlled trials,' that is illustrative of how economists applied the communication theory of diffusion of innovations to their projects of social change. The present article poses questions and makes recommendations for similar future projects from a communication perspective.

ARTICLE HISTORY
Received 14 November 2019
Accepted 12 January 2020

KEYWORDS
Diffusion of innovations; opinion leaders; global poverty reduction; social network analysis; economics; diffusion network

For 20 years, economists Abhijit Banerjee and Esther Duflo of the Massachusetts Institute of Technology and Michael Kremer of Harvard University have pioneered a large-scale, field-experimental approach for demonstrating methods to alleviate poverty in some of the poorest regions of the world. Their work, conducted with teams of colleagues and on-the-ground practitioners in the United States and abroad, and funded by the National Science Foundation and other agencies, has addressed ways to improve education, health care, and microfinance at the level of poor communities. In 2019, the three professors shared the Nobel Prize in Economic Sciences for transforming the field of development economics (The Nobel Prize, 2019).

One of the key perspectives that Banerjee, Duflo, Kremer and colleagues rely on in their work is the diffusion of innovations research and practice paradigm which has long been taught in departments of communication and studied by communication scholars as well as rural sociologists, health services researchers, engineers, community psychologists, education researchers, etc. Indeed, long before Banerjee, Duflo and Kremer's program of research and its collective contribution to the field of development economics, communication researchers, including Wilbur Schramm in partnership with

CONTACT Do Kyun D. Kim kimcomm@louisiana.edu

sociologists and political scientists, including Daniel Lerner and Ithiel de Sola Pool, contributed centrally to the establishment of the field of international development in which communication and diffusion figured prominently. Contemporary communication scholars build on this tradition. We, for example, study diffusion processes and concepts as they relate to the flow of health improvement interventions between other countries and the U.S. (Adams et al., 2014; Valente et al., 2015), social movements and information flow through social media (González-Bailón & Wang, 2016; Valenzuela et al., 2014), computational simulations of diffusion processes, and the scale up of pro-social programs in education (Beets et al., 2008; Frank et al., 2004), youth development (Fixsen et al., 2011; Tremblay et al., 2016), and public health and carbon mitigation (Axon, 2016; Geels et al., 2018).

As communication researchers who use and contribute to the body of diffusion research, we find Banerjee et al.'s work both pathbreaking and curious. Pathbreaking because of the scale at which they have carried out field experiments, the good that they have done, and the new methods that they have demonstrated to promote diffusion. Curious, because they have ignored much of what is known and empirically established about how diffusion occurs and why. We write the present article because we believe that researchers working in development economics could borrow more than they have from communication scholarship and to greater effect. We do so by focusing on one representative article by this group, *Using gossips to spread information: Theory and evidence from two randomized controlled trials* (Banerjee et al., 2019) published in *The Review of Economic Studies*. We identify diffusion concepts that, if operationalized as part of a communication strategy, could usefully augment future diffusion studies by embracing what is known about the communication of innovations.

Diffusion of Innovations: An interdisciplinary communication theory

Everett M. Rogers synthesized and in so doing popularized the diffusion of innovations paradigm. Rogers (1962) defined *diffusion* as 'a process in which an innovation is communicated through certain channels over time among the members of social system' (p. 5), in which a social system may be an organization, a geographically-based community or social aggregate, or an interest-based virtual community (i.e. community of practice). Diffusion relies on both information dissemination and interpersonal influence for people to decide to adopt an innovation or not. Ideas, objects, technologies, behaviors and beliefs, programs and interventions, and policies have all been studied as innovations, meaning that they are perceived to be new by an individual or other unit of adoption such as a team within an organization.

Diffusion is a subset or specific type of communication in that what is communicated is always perceived to be new. Newness, when combined with perceived relevance or importance, creates uncertainty in potential adopters. Uncertainty leads to a desire to resolve it through a search for more information, especially in instances of cognitive inconsistency. Diffusion studies have shown the importance both of impersonal sources of information, such as mass media, and personal sources, such as credible others (near peers). Potential adopters frequently turn to the latter when they believe the innovation to have important consequences for how they live or work.

Diffusion varies by several factors including how an innovation is perceived by potential adopters, features of communication within a target population, choice of communication channels (or means of information delivery), and culture related to the decision-making process in a social system. Among these many variables, the Nobel laureates tested the role of opinion leaders (credible others) in the process of diffusion and the adoption decisions that individuals make (Rogers, 2003).

Opinion leaders constitute a small proportion (often about 5%) of all potential adopters. They do not necessarily occupy higher status in organizations or communities; rather they are sought out for their trustworthiness, expertise, and accessibility to those seeking advice or a social model example (Dearing & Cox, 2018; Dearing & Singhal, 2006; Kee et al., 2016; Kim et al., 2013). Approaches to spread innovations by harnessing opinion leaders, instead of randomly selected individuals, have proven effective in reducing uncertainty and cost in a diffusion process and routinizing the adoption sustainably (Greenhalgh et al., 2004). Having such critical advantages for diffusion of innovations, opinion leader-based strategies have been applied to a number of projects across different areas of praxis, such as public health promotion (Dearing, 2009; Kee et al., 2016), business (Iyengar et al., 2011), education (Kim et al., 2018), environmental protection (Nisbet & Kotcher, 2009), as well as economic development as in the case of the Nobel laureates' experiments discussed in this article.

Using gossips to spread information: the Nobel Prize winning experiments

According to the most recent estimates presented by the World Bank, 10% of the world's population in 2015 lived on less than US $1.90 a day, with approximately 1.2 billion people in the world now living in extreme poverty (World Bank, 2019a). Major challenges to ending such extreme poverty remain in place with poverty worsening in many countries (World Bank, 2019b). Economic conditions represent only part of the equation resulting in and sustaining severe poverty, of course; primary education and public health are also broken in many places, as the seventh Secretary General of the United Nations, Kofi Annan, stated at the 54th World Health Assembly (United Nations, 2001).

One of the major studies conducted by Banerjee et al. (2019) in this line of research for poverty reduction and healthcare service promotion examined a conventional diffusion question by studying how to best identify individuals in communities who can effectively diffuse information. To answer this question, the researchers conducted two field experiments. The first experiment involved 213 villages in Karnataka, India, in which researchers either spread information about an opportunity to win a free cell phone or, for all other participants, a less-valuable cash award. The dependent variable was the number of calls from each village to an advertised phone number that entered the callers into the contest. Villages were randomly assigned to one of three conditions, with 71 villages in each condition. In each village, the researchers recruited 3–5 households to initiate a diffusion process. How the households were selected is what distinguished the three experimental conditions. In condition 1, households were randomly selected; in condition 2, households of village elders with higher social status were purposively selected; and in condition 3, households were asked to nominate people in the village who would be good at spreading information, and these 'gossips' were then invited to diffuse the information. From this first experiment, the authors found that diffusion of information was greatest in condition

3 villages where nominees began the information diffusion process, although the other conditions generated diffusion, as well.

The same article reports the results of a second experiment conducted with 517 villages in Haryana, India, in which the type of information diffused was considered to be more important because it concerned the need to immunize children. This experiment was designed with 4 conditions. In condition 1, 17 randomly selected households were surveyed and asked who in the village would be good at diffusing information; in condition 2, 17 randomly selected households were surveyed and asked who in the village was most trusted; in condition 3, households were asked who would be both good at diffusing information and trusted; and in condition 4, no nominations were solicited. The six most nominated persons in conditions 1, 2 and 3 in each village were then visited and recruited to spread information about immunization, while in condition 4, six households were randomly selected, visited and recruited. The number of children immunized in each of the 517 villages was monitored for one year. The result was the same as the first experiment, showing the effectiveness of asking villagers to nominate others who would be good at spreading information. As the authors pointed out, these experiments demonstrated that ordinary people (villagers) are able to identify effective diffusers of information without researchers having to use social network analysis to identify key nodes in each village. When social network analysis is used to identify influential members of a community, a population survey is often administered, although alternative means of data collection about influence do exist (Dearing et al., 2018; Kim & Dearing, 2016).

Making greater use of prior diffusion research

Like many investigations before it, the Banerjee et al. (2019) study confirms the principle of homophily in diffusion processes (Rogers & Bhowmik, 1970). Instead of people with higher status in a social system, such as elders in villages who seldom interact with those of a lower status, informal opinion leaders (some of whom may also be of high status) are trusted, accessible, and experts who can help spread information and innovations effectively. The Banerjee et al. (2019) experiments also confirm the importance of proximity: The less distance between people, the faster and wider diffusion can go into the social system. Although this 'gossip' study followed core ideas of opinion leader-based diffusion strategies, it demonstrated some limitations that need to be seriously considered in future diffusion studies. This article provides the limitations and recommendations from a communication perspective in order to reduce uncertainty and enhance effectiveness in the diffusion process.

Diffusion theory suggests other concepts that affect adoption, implementation, and continued use of an innovation that the Banerjee et al. (2019) study does not address. Cultural norms, for example, are usually a critical factor that affect diffusion. When a social system's norms favor change, opinion leaders are more innovative, but when the norms do not favor change, opinion leaders are not especially innovative (Rogers, 2003, p. 318). This generalization, along with others, underlines the importance and resilience of culture in a social system. Depending on the kind of culture a social system has, people may engage in different patterns of communication that in turn shapes their behaviors, selection of communication channels, and ways of interacting (e.g. Straub, 1994; Wejnert, 2002; Yaveroglu & Donthu, 2002).

Along with culture, message design is also important. Message design underlies how people interpret, re-interpret or even mis-interpret information (Gallois, 2003) as it spreads in ways unintended by change agents. Banerjee et al. (2019) state, 'this paper focuses on the pure transmission of information – simple knowledge that is either known or not' (p. 2486). However, from a communication perspective, it is known that information can be distorted through encoding and decoding. The authors explain, for example, that in their first experiment villagers exchange information about a contest. During diffusion, it is likely that the villagers would have also talked about or asked why anyone would offer such a game, whether the offer was legitimate, how their cell numbers might be used or appropriated for commercial purposes. The inherent challenges in diffusion processes can be further compounded by the risks of misinterpretation due to a lack of consideration of culture that shapes patterns of communication.

While a spectacular enactment of large-scale field experiments, the 'gossip' study also diminishes the importance of types of information, stating 'the information that was circulated is not particularly important.' Their rationale for this was partly that the application itself was not of direct policy interest (Banerjee et al., 2019, p. 2456). It could have been instructive for the authors to vary the content, or framing, of the message itself, including its perceived importance. Individuals readily process the same information in different ways as the Elaboration Likelihood Model has shown with numerous studies (see Hamilton et al., 1993). Many studies on message design have shown how different messages create different perceptions among individuals and, therefore, different behavioral decisions.

Similar to the previous point is the importance of framing (e.g. positive/negative, gain/loss frames). The ways that an innovation (information) is framed also affect diffusion processes, including the unexpected production of reactance (see Liang et al., 2018). Furthermore, when introduced into a complex web of social relationships and cultural norms in low-income countries, the ways that information is framed politically, religiously, etc., can influence how people will supplement the base message with personal comments, endorsements, questions, jokes, and/or disapproval in ways unintended by the change agents.

Communication research also recognizes the audience and the diversity of audience segments (Webster & Ksiazek, 2012), not just the source. How would different audience segments respond to the selected nominees, given ingroup and outgroup memberships? How would villagers respond to the same information seeds if the few gossip nominees are always tapped for certain types of information? Villagers may begin to pay less attention over time, due to routinization, boredom, or other concerns. Perhaps villagers would begin to develop skepticism about the gossip nominees over time, making them less persuasive. In other words, the intended audience may pay less attention to the recruits and less susceptible to the gossip nominees' influence in the long term if they are being used for information diffusion repeatedly.

Even if they are members of villages and subject to system norms, gossip nominees are independent and autonomous individuals (Scott, 2006). They cannot be forced to help change agents spread information. The authors state '(t)he central question of this paper is how to find the best (most effective) people to seed for a diffusion process' (p. 2454). While they did acknowledge that 21% of their recruits in the second experiment declined to participate, the way gossip nominees as information seeds are conceptualized

in the paper is large as somewhat passive mediators who are willing to pass along new information in their villages. In addition, the authors seeded information in 3–5 households for each village in the first experiment, and 6 households in the second. This is an important consideration if these information seeds will be repeatedly targeted for the same communication tasks within their village.

When information requires a considerable opportunity cost, knowledge-practice gaps between people's awareness of information and suggested behaviors frequently occur. The '*gossip*' study utilized information that requires very little opportunity cost to get certain outcomes (e.g. cell phones, cash, and immunization). However, poverty reduction programs often involve the adoption of consequential, behaviorally complex innovations with elaborate and recurrent implementation actions rather than the very simple kinds of rumor and information that these two experiments concerned. It would be important to know the extent to which the results of Banerjee et al. (2019) apply to more behaviorally engaging innovations. They may not, and thus cannot provide an alternative means of identifying effective nodes in village networks for improved education, health or income generation. Future studies could consider more seriously the link between cognitive and behavioral sciences to build collective knowledge about research to practice parameters in the context of low-income country villages.

While Banerjee et al. (2019) recognize the importance of studying communication networks, they underemphasize the importance of network configurations (Atouba & Shumate, 2010). Information seeds are important, but so are *bridges,* who connect the peripheral nodes and groups with the rest of the network, and *brokers,* who facilitate transactions as intermediary actors between people lacking access to or trust in one another (Marsden & Lin, 1982). Without them, a communication network is fragmented, and information diffusion can come to an abrupt halt, preventing network saturation of well-intended information for social change. Similarly, the study also did not take network isolates into account, some of whom are typically the nodes most in need of intervention. Those individuals who are isolated in communities are frequently economically challenged and informationally deprived, while positive deviants often have solutions for poverty reduction (Pascale et al., 2010; Singhal, 2010). How to reach them is overlooked in the approach of tapping into village networks via gossip nominees.

Communication network research has shown that both weak and strong ties (Rojas et al., 2011) have different effects on information diffusion. For example, health prevention innovations, such as family planning and HIV prevention vaccines such as Pre-Exposure Prophylaxis (PrEP), may carry with them familial implications and/or social stigmas (where strong ties are important for social support), and thus operate differently from information about contests and the need to immunize children (where weak ties are appropriate). The authors did state,

> [I]t is important to note that highly central individuals are generally closer to people than the typical household (since the most central people tend to have more friends – the famous 'friendship paradox'), so it does make sense that people tend to nominate individuals who are closer to them. (p. 2480)

However, the relationships among gossip nominees and other villagers requires more attention, as it may be a change function in a village with high personal costs if stigmas are involved.

Drs. Benerjee, Duflo, and colleagues explained that the goal of their experiments was to examine the question, 'How can one easily and cheaply identify highly central individuals without gathering network data?' But, we caution readers not to oversimplify the diffusion process, especially in developing contexts. Let us also clarify that our purpose is not to criticize the important work for the sake of criticism. We believe the work they did is innovative, likely leading to accelerating information diffusion for social change. However, our critiques are meant to point out the potential blind spots and possible next steps after taking their diffusion approach of using gossip nominees, while expanding this work for reducing global poverty and adding insights and wisdoms from decades of communication research broadly. Finally, the blind spots and next steps we laid out can also serve as research agendas for communication scholars, with the hope that this line of work, recognized by the Nobel Prize Committee, will trigger an increase in interests of studying and examining diffusion of innovations as a communication theory.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

Adams, V., Burke, N. J., & Whitmarsh, I. (2014). Slow research: Thoughts for a movement in global health. *Medical Anthropology*, *33*(3), 179–197. https://doi.org/10.1080/01459740.2013.858335

Atouba, Y., & Shumate, M. (2010). Interorganizational networking patterns among development organizations. *Journal of Communication*, *60*(2), 293–317. https://doi.org/10.1111/j.1460-2466.2010.01483.x

Axon, S. (2016). "The good life": Engaging the public with community-based carbon reduction strategies. *Environmental Science & Policy*, *66*, 82–92. https://doi.org/10.1016/j.envsci.2016.08.007

Banerjee, A., Chandrasekhar, A. G., Duflo, E., & Jackson, M. O. (2019). Using gossips to spread information: Theory and evidence from two randomized controlled trials. *The Review of Economic Studies*, *86*(6), 2453–2490. https://doi.org/10.1093/restud/rdz008

Beets, M. W., Flay, B. R., Vuchinich, S., Acock, A. C., Li, K. K., & Allred, C. (2008). School climate and teachers' beliefs and attitudes associated with implementation of the positive action program: A diffusion of innovations model. *Prevention Science*, *9*(4), 264–275. https://doi.org/10.1007/s11121-008-0100-2

Dearing, J. W. (2009). Applying diffusion of innovation theory to intervention development. *Research on Social Work Practice*, *19*(5), 503–518. https://doi.org/10.1177/1049731509335569

Dearing, J. W., & Cox, J. G. (2018). Diffusion of innovations theory, principles and practice. *Health Affairs*, *37*(2), 183–190. https://doi.org/10.1377/hlthaff.2017.1104

Dearing, J. W., Kee, K. F., & Peng, W. (2018). Historical roots of dissemination and implementation science. In R. Brownson, G. Colditz, & E. Proctor (Eds.), *Dissemination and implementation research in health: Translating science to practice* (pp. 47–61). Oxford University Press.

Dearing, J. W., & Singhal, A. (2006). *Communication of innovations: A journey with Ev Rogers*. Sage.

Fixsen, D. L., Blase, K. A., & Van Dyke, M. K. (2011). Mobilizing communities for implementing evidence-based youth violence prevention programming: A commentary. *American Journal of Community Psychology*, *48*(1-2), 133–137. https://doi.org/10.1007/s10464-010-9410-1

Frank, K. A., Zhao, Y., & Borman, K. (2004). Social capital and the diffusion of innovations within organizations: The case of computer technology in schools. *Sociology of Education*, *77*(2), 148–171. https://doi.org/10.1177/003804070407700203

Gallois, C. (2003). Reconciliation through communication in intercultural encounters: Potential or peril? *Journal of Communication*, *53*(1), 5–15. https://doi.org/10.1111/j.1460-2466.2003.tb03001.x

Geels, F. W., Schwanen, T., Sorrell, S., Jenkins, K., & Sovacool, B. K. (2018). Reducing energy demand through low carbon innovation: A sociotechnical transitions perspective and thirteen research debates. *Energy Research & Social Science*, *40*, 23–35. https://doi.org/10.1016/j.erss.2017.11.003

González-Bailón, S., & Wang, N. (2016). Networked discontent: The anatomy of protest campaigns in social media. *Social Networks*, *44*, 95–104. https://doi.org/10.1016/j.socnet.2015.07.003

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *The Milbank Quarterly*, *82*(4), 581–629. https://doi.org/10.1111/j.0887-378X.2004.00325.x

Hamilton, M. A., Hunter, J. E., & Boster, F. J. (1993). The elaboration likelihood model as a theory of attitude formation: A mathematical analysis. *Communication Theory*, *3*(1), 50–65. https://doi.org/10.1111/j.1468-2885.1993.tb00056_3_1.x

Iyengar, R., Van den Bulte, C., & Valente, T. W. (2011). Opinion leadership and social contagion in new product diffusion. *Marketing Science*, *30*(2), 195–212. https://doi.org/10.1287/mksc.1100.0566

Kee, K. F., Sparks, L., Struppa, D. C., Mannucci, M., & Damiano, A. (2016). Information diffusion, Facebook clusters, and the simplicial model of social aggregation: A computational simulation of simplicial diffusers for community health interventions. *Health Communication*, *31*(4), 385–399. https://doi.org/10.1080/10410236.2014.960061

Kim, D. K., Chikombero, M., & Modie-Moroka, T. (2013). Innate health threat among a visibly hidden immigrant group: A formative field data analysis for HIV/AIDS prevention among Zimbabwean workers in Botswana. *Journal of Health Communication*, *18*(2), 146–159. https://doi.org/10.1080/10810730.2012.688252

Kim, D. K., & Dearing, J. W. (2016). Opinion leader identification. In D. K. Kim & J. W. Dearing (Eds.), *Health communication research measures* (pp. 77–86). Peter Lang.

Kim, D. K., Dinu, L., & Kim, C. G. (2018). Adoptability of E-textbooks featuring educational online games. In Information Resources Management Association (Ed.), *Gamification in education: Breakthroughs in research and practice* (pp. 338–355). IGI-Global.

Liang, Y., Kee, K. F., & Henderson, L. K. (2018). Towards an integrated model of strategic environmental communication: Advancing theories of reactance and planned behavior in a water conservation context. *Journal of Applied Communication Research*, *46*(2), 135–154. https://doi.org/10.1080/00909882.2018.1437924

Marsden, P., & Lin, N. (1982). *Social structure and network analysis*. Sage.

Nisbet, M. C., & Kotcher, J. E. (2009). A two-step flow of influence? Opinion-leader campaigns on climate change. *Science Communication*, *30*(3), 328–354. https://doi.org/10.1177/1075547008328797

The Nobel Prize. (2019). *Press release: The Prize in Economic Sciences 2019*. https://www.nobelprize.org/prizes/economic-sciences/2019/press-release/

Pascale, R., Sternin, J., & Sternin, M. (2010). *The power of positive deviance: How unlikely innovators solve the world's toughest problems*. Harvard Business Review Press.

Rogers, E. M. (1962). *Diffusion of innovations* (1st ed.). Free Press.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Rogers, E. M., & Bhowmik, D. K. (1970). Homophily – heterophily: Relational concepts for communication research. *Public Opinion Quarterly*, *34*(4), 523–538. https://doi.org/10.1086/267838

Rojas, H., Shah, D. V., & Friedland, L. A. (2011). A communicative approach to social capital. *Journal of Communication*, *61*(4), 689–712. https://doi.org/10.1111/j.1460-2466.2011.01571.x

Scott, W. G. (2006). Communication and centralization of organization. *Journal of Communication*, *13*(1), 3–11. https://doi.org/10.1111/j.1460-2466.1963.tb02077.x

Singhal, A. (2010). Communicating what works! Applying the positive deviance approach in health communication. *Health Communication*, *25*(6-7), 605–606. https://doi.org/10.1080/10410236.2010.496835

Straub, D. W. (1994). The effect of culture on IT diffusion: E-mail and FAX in Japan and the US. *Information Systems Research*, *5*(1), 23–47. https://doi.org/10.1287/isre.5.1.23

Tremblay, M. S., Carson, V., Chaput, J.-P., Connor Gorber, S., Dinh, T., Duggan, M., Faulkner, G., Gray, C. E., Gruber, R., Janson, K., Janssen, I., Katzmarzyk, P. T., Kho, M. E., Latimer-Cheung, A. E., LeBlanc, C., Okely, A. D., Olds, T., Pate, R. R., Phillips, A., … Zehr, L. (2016). Canadian 24-hour movement guidelines for children and youth: An integration of physical activity, sedentary behaviour, and sleep. *Applied Physiology, Nutrition, and Metabolism*, *41*(6 (Suppl. 3)), S311–S327. https://doi.org/10.1139/apnm-2016-0151

United Nations. (2001). *Poverty: Biggest enemy of health in developing world, Secretary-General tells world health assembly*. https://www.un.org/press/en/2001/sgsm7808.doc.htm

Valente, T. W., Dyal, S. R., Chu, K. H., Wipfli, H., & Fujimoto, K. (2015). Diffusion of innovations theory applied to global tobacco control treaty ratification. *Social Science & Medicine*, *145*, 89–97. https://doi.org/10.1016/j.socscimed.2015.10.001

Valenzuela, S., Arriagada, A., & Scherman, A. (2014). Facebook, Twitter, and youth engagement: A quasi-experimental study of social media use and protest behavior using propensity score matching. *International Journal of Communication*, *8*, 25. https://ijoc.org/index.php/ijoc/article/view/2022

Webster, J. G., & Ksiazek, T. B. (2012). The dynamics of audience fragmentation: Public attention in an age of digital media. *Journal of Communication*, *62*(1), 39–56. https://doi.org/10.1111/j.1460-2466.2011.01616.x

Wejnert, B. (2002). Integrating models of diffusion of innovations: A conceptual framework. *Annual Review of Sociology*, *28*(1), 297–326. https://doi.org/10.1146/annurev.soc.28.110601.141051

The World Bank. (2019a). *Health and development: Poverty and health*. https://www.who.int/hdp/poverty/en/

The World Bank. (2019b). *Poverty: Overview*. https://www.worldbank.org/en/topic/poverty/overview

Yaveroglu, I. S., & Donthu, N. (2002). Cultural influences on the diffusion of new products. *Journal of International Consumer Marketing*, *14*(4), 49–63. https://doi.org/10.1300/J046v14n04_04