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Getting the Word Out: New Approaches for Disseminating Public Health Science

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ABSTRACT
The gap between discovery of public health knowledge and application in practice settings and policy development is due in part to ineffective dissemination. This article describes (1) lessons related to dissemination from related disciplines (eg, communication, agriculture, social marketing, political science), (2) current practices among researchers, (3) key audience characteristics, (4) available tools for dissemination, and (5) measures of impact. Dissemination efforts need to take into account the message, source, audience, and channel. Practitioners and policy makers can be more effectively reached via news media, social media, issue or policy briefs, one-on-one meetings, and workshops and seminars. Numerous "upstream" and "midstream" indicators of impact include changes in public perception or awareness, greater use of evidence-based interventions, and changes in policy. By employing ideas outlined in this article, scientific discoveries are more likely to be applied in public health agencies and policy-making bodies.

KEY WORDS: dissemination, evidence-based, policy, practice, translation

Knowing is not enough; we must apply.

Willing is not enough; we must do.

Johann Wolfgang von Goethe

A research-practice gap exists across all fields of public health and medical practice as well as in other disciplines as diverse as education, engineering, music, psychology, business, and agriculture.[1,2] Our inability or unwillingness to apply what is known to improve health results in significant health deficits and persistent inequalities. For example, it is estimated that the lives of 6 million children could be saved each year if 23 proven interventions were implemented in 42 countries.[3]

Numerous examples in public health illustrate the promise and challenges in reducing the gap between research and practice. Successful translation was shown in state-based tobacco control programs in California and Massachusetts.[4,5] These programs involved multilevel interventions with policy, communication, and dissemination components leading to reduced tobacco use rates. Some of the lessons from these 2 states formed the basis for the *Best Practices for Comprehensive Tobacco Control Programs*,[6] which has been widely disseminated. Less optimal translation has been observed in the Drug Abuse

Resistance Education program—a widely used, but potentially ineffective, school-based drug use prevention program in the United States.[7-9] Evaluations of the Drug Abuse Resistance Education program have shown that the program is either ineffective or shows mixed results in preventing substance use behavior.[10-12]

The so-called "translation gap" is partially due to ineffective dissemination. We have learned numerous lessons regarding the dissemination of public health research to practice and policy audiences. First, passive approaches to dissemination are largely ineffective because uptake does not happen spontaneously.[13,14] Second, stakeholder engagement in research and evaluation processes is likely to enhance dissemination.[15,16] Third, the dissemination of research to nonscientists is enhanced when messages are framed in ways that evoke emotion and interest and demonstrate usefulness.[17] Fourth, at an agency level (eg, health departments, community-based organizations), dissemination approaches should be time-efficient, consistent with organizational climate, culture, and resources, and aligned with the skills of staff members.[18] Fifth, dissemination to policy audiences needs to take into account unique characteristics of policy makers as dissemination targets (eg, time horizons, need for local data).[19,20] And sixth, the objective of research dissemination is to achieve impact; measures of academic impact often differ significantly from the markers of importance to practice and policy audiences.[21]

While a majority of researchers value dissemination[22] and many funding agencies now require a plan that outlines dissemination among nonacademic audiences (eg, practitioners, policy makers, the public),[23] specific guidance on how best to accomplish effective dissemination is lacking. To address this gap, in this article, we review lessons from related disciplines, current practices of researchers, key audience characteristics, available tools for dissemination, and measures of impact of dissemination efforts.

What Might We Learn From Diverse Disciplines?

Lessons and theory from several disciplines outside the health sector help inform dissemination of research to practice and policy. A classic communication model was developed by Shannon and Weaver in the middle of the last century—this model has been widely used in diverse fields such as education, business, and psychology.[24,25] It remains highly relevant today. Through this article, we use this basic model to illustrate key points in the dissemination of research for public health impact (Figure). The model begins with the *message*—that is, What is the information or
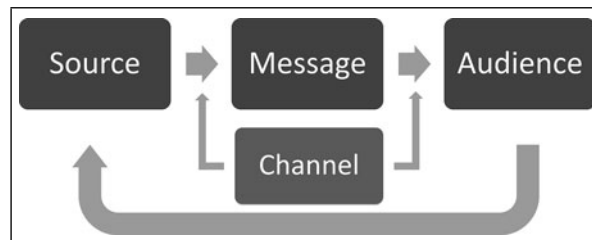

FIGURE Model for Dissemination of Research

scientific discovery to be disseminated? It also highlights that dissemination is not a linear process but one with multiple inputs and feedback loops.

Another key set of principles emanates from Diffusion of Innovations Theory, which originated in the agricultural sector.[26,27] A fundamental premise of Diffusion Theory is that some innovations diffuse quickly and widely, following a classic S-curve. The innovators, individuals who seek novelty, are only a small proportion of the overall population. A subset of early adopters comprises the opinion leaders who contribute greatly to the spread of innovations. Diffusion of Innovations was one of the first attempts to specify the dissemination process through a stage-ordered model of awareness, persuasion, decision, implementation, and confirmation.[2] Diffusion Theory shows important attributes of the innovation (the message), namely, that it needs to show an advantage over existing practices, it should be tried out on a small scale, and that costs matter.[28]

Social marketing, first articulated by Kotler and Zaltman in the 1970s,[29] uses marketing principles to influence a target audience to voluntarily accept, reject, modify, or abandon a behavior for the benefit of individuals, groups, or society as a whole. The process of social marketing seeks to apply commercial marketing principles to promote positive public health behaviors. Core elements involve a focus on the 4 Ps of product, price, place, and promotion.[29,30] One of the key lessons from social marketing campaigns is that message-based communication of knowledge alone is unlikely to lead to sustained behavior change.[31]

Finally, a relevant set of concepts from political science comes from Kingdon's[32] agenda setting, multiple streams theory. This framework suggests that policies move forward when elements of 3 "streams" come together. The first of these is the definition of the problem (eg, a high diabetes rate). The second is the development of potential policies to solve that problem (eg, identification of policy measures to achieve an effective diabetes control strategy). Finally, there is the role of politics and public opinion (eg, interest groups supporting or opposing the policy). Policy change occurs when a "window of opportunity" opens and the 3

streams push policy change through. A tenet of Kingdon's model is that policy makers are constantly on the receiving end of sometimes disconnected, random, and chaotic messages.[32,33]

Motivations and Current Practices Among Researchers (the *Source*)

The methods researchers use to disseminate their findings tend to be passive and traditional among academics and not necessarily those that best connect stakeholders with research evidence. In one study, 75% of public health researchers reported that dissemination to nonresearch audiences was important.[34] However, the same study found that the most frequently reported dissemination methods were academic journals (99%), followed by academic conferences (81%).[22,34] Methods used less commonly included seminars and workshops (69%), face-to-face meetings (50%), press releases (33%), and media interviews (33%), which was similar to findings from researchers in the United Kingdom.[35] When rating their dissemination efforts, only 28% of this group reported that their efforts were excellent or good.[34] Several factors predicted whether researchers reported excellent or good dissemination efforts, giving some indication of what motivates scientists. These variables included feeling obligated to disseminate their findings; thinking that dissemination is important to their department, employer, or funder; and having worked in a practice/policy setting. A study analyzing data across 3 countries found that factors making it easier to disseminate research findings such as a unit/department/school with a formal communication dissemination strategy were rarely available.[36] One approach with potential to improve translation of research to practice is designing for dissemination: an active process that helps ensure that public health interventions, often evaluated by researchers, are developed in ways that match well with adopters' needs, assets, and time frames.[22] However, most researchers report rarely engaging in the activities that characterize designing for dissemination (ie, only one-third of respondents to a survey of US scientists always or usually involved stakeholders in the research process).[22]

Knowing Whom to Impact (the *Audience*)

The characteristics of the audience are important in shaping a dissemination strategy. The concept of audience segmentation has its roots in social sciences and social philosophy over the past century.[37] It is a widely accepted principle in marketing and in shaping effective health communication campaigns. In a social marketing context, the idea is simple—there is

a higher likelihood of success when a product and promotion strategy is targeted to the characteristics of a desired segment. Two key audiences for dissemination are public health practitioners and policy makers—these groups share some characteristics but also have important differences (Table 1).

Framing is another important factor in considering audiences for dissemination. Individuals can interpret the same data in different ways depending on the mental model through which they perceive information.[39] A productive way of framing for public health audiences involves weighing the benefits (gains) versus risks (losses).[40] People often perceive risks and benefits not in scientific terms but in regard to psychological, emotional, moral, or political frameworks.[41] The objective of an effective dissemination strategy is to appeal to an audience in a way in which the benefits (eg, lives saved by a new policy) outweigh the risks (eg, economic or opportunity costs[42]). In seeking to reach practitioners and policy makers, it is useful to take into account several differences in how decisions are made across these groups (Table 1). We describe key characteristics for 2 audiences (practitioners, policy makers) who are likely targets of dissemination efforts.

Public health practitioners

The workforce in public health practice is diverse in terms of experience and job duties,[43] and formal training of persons working in public health is much more variable than that in medicine or other clinical disciplines.[44] Most public health practitioners lack formal training in 1 or more public health disciplines (eg, epidemiology, health behavior, environmental health). While public health practitioners place value on evidence-based approaches and dissemination of science to practice,[43] the heterogeneity of the workforce presents challenges. For example, one of the biggest considerations involves how practitioners learn about the latest evidence.[45] As noted previously, academic journals and conferences are by far the most common methods by which researchers disseminate their research.[46,47] Studies among state public health practitioners have shown that only 46% use journals in their day-to-day work[48] and use is lower (33%) at the local level.[49] Lack of access is a major barrier to journal use.[48] Other barriers to use of scientific information include time, resource reliability, trustworthiness/credibility of data, and information overload.[50] Approaches for connecting practitioners with the generators of evidence need to take into account the barriers to dissemination of research information to day-to-day public health practice. To address access, more journals are moving toward

TABLE 1			
Differences in Decision-Making Among Public Health Practitioners and Policy Makers[a]			
Characteristic	**Executive Branch, Public Health Practitioner**	**Legislative Branch, Elected Official**	**Legislative Branch, Staff Member**
Time in position	Longer	Shorter	Shorter
Accountability	Governor, board of health, agency head	Constituents by whom they are elected, political party	Elected legislator, committee chair
Personal connection to constituents	Moderate	High	High to moderate
Knowledge span	Deeper knowledge on health issues (often more specialized in larger agencies)	Less depth, wider breadth	Less depth, wider breadth
Decision-making based on external factors[b] (aside from research)	Low to moderate	High	High
Time spent on a particular issue	Longer	Shortest	Shorter
Type of evidence relied upon	Science, evidence reviews, experience from the field, personal experience	"Real world" stories, constituents, gatekeepers, party priorities, media, science	"Real world" stories, constituents, gatekeepers, party priorities, media, science

[a]Reprinted with permission from Brownson and Jones.[38]
[b]External factors commonly include habit, stereotypes, and cultural norms.

arrangements that allow for freely available content. One approach is open access, where the author purchases the copyright to the article allowing free distribution online under most licenses. While open access provides the most freedom to disseminate, it is also the most costly. An increasing number of journals charge publication fees to authors allowing articles to be fully open access. Many other publications are adopting an alternative approach in which individual articles or full supplemental issues are freely available to nonsubscribers on the journal's Web site after an author pays a sponsorship fee (eg, the *Journal of Public Health Management & Practice*). A few journals have identified external or pooled funding from organizational subscribers to allow for full open access without fees to authors (eg, the *Annual Review of Public Health* now provides open access to all volumes under a Creative Commons license).

Policy makers

Policy makers are key decision makers at the local, state, and federal levels. They may be elected officials or appointed agency leaders. Although policy makers may differ in their role in the policy-making process (Table 1), most have responsibilities and priorities that preclude them from spending a lot of time reading or reviewing in detail the materials provided to them. Studies show that their interest in issues is guided by party priorities and emphasized by "real-world" stories from their constituents.[38,51] Policy makers seek

out information that is understandable, concise, and unbiased. It is also helpful to provide information to them that is locally relevant (eg, health surveillance data). Recommended actions or options should be included, as well as cost-effectiveness or economic impact if available. In addition to busy schedules, policy makers are often in demand by people and organizations soliciting support for policies or initiatives.[52] As such, they likely rely on staff to help them discern priority information. Staffers of policy makers are a key target audience for dissemination efforts.[38,40]

Reaching Your Audience (the *Channel*)

There are multiple approaches or channels for reaching various audiences. Table 2 provides a cross-setting set of approaches.[15,22,53-55] It is often most useful to begin by developing a dissemination plan.

News media

The news (traditional) media (radio, television, newspapers) can be an important channel for reaching practitioners and policy makers. The media often sets the agenda and frames public health issues by highlighting which topics are newsworthy at a particular time.[40,56] Researchers view the media as one of the main ways by which to convey research findings to policy makers,[23] although gaps remain regarding the effectiveness of media in affecting policy.[57]

When linking with the news media for dissemination, it is useful to keep a few issues in mind. While

TABLE 2
Approaches and Tools for Disseminating to Nonresearch Audiences[a]

Approach	Tools
Develop a dissemination plan early in the process	https://www.ahrq.gov/professionals/quality-patient-safety/patient-safety-resources/resources/advances-in-patient-safety/vol4/planningtool.html
	http://www.who.int/tdr/publications/year/2014/participant-workbook5_030414.pdf
Engage with stakeholders for dissemination planning; may include advisors, team members, coauthors	https://researchtoreality.cancer.gov
	https://ccph.memberclicks.net/ http://ctb.ku.edu/en
Select and use a dissemination framework	Reviews of dissemination frameworks[44,45] http://dissemination-implementation.org/index.aspx
Make use of social media	Twitter, Facebook, LinkedIn
Create and share podcasts	YouTube
Describe research in personal blogs	Tumblr, Wordpress
Prepare brief summaries of research (policy briefs, issue briefs)	https://www.cdc.gov/policy/polaris/policy-resources-writing-briefs.html
Seek advice from media and public relations experts	http://bwhresearch.org/wp-content/uploads/2015/10/PCERC-Dissemination-Best-Practices-Resource-Document.pdf
	http://www.nwcphp.org/communications/news/six-tips-for-effective-media-relations

[a]Adapted from Brownson et al,[22] Tripathy et al,[55] and Keown et al.[15]

"news media" is a blanket term, within this heading there are many small and large outlets and formats (newspapers, television, radio, blogs). Larger outlets will often have a health reporter whereas smaller organizations will have fewer individuals covering diverse topics. The news media is a business that relies heavily on advertising dollars—and in some cases may avoid offending their advertisers. As such, perceptions of the media as politically biased[58] or agenda driven[59] can influence audience receptiveness and response to the stories they publish. There is a sizable body of research showing the characteristics of news stories that typically gain attention.[40,60] Several key factors include (1) the seriousness of the problem, (2) human interest, often in the form of a personal story, (3) a local angle for a national or state headline, (4) timeliness, and (5) conflict or controversy.

When preparing for interaction (dissemination) with the news media, there are specific recommendations[61]:

- Most larger public health organizations (academic institutions, health departments, nongovernmental organizations) will have a designated contact person (a press officer or some similar title). That individual can assist with the process (including writing and disseminating a press release, when appropriate).
- Prepare for the interview by learning the deadline for the story, the focus of the piece, and who else will be interviewed.
- Develop a single overriding health communication objective that is the most important thing to be said to a reporter (and that you hope will appear in the lead of the story).
- Speak in nontechnical language and use numbers sparingly.
- Answer questions appropriately by elaborating key points and avoiding "yes" or "no" answers.

Social media

The percentage of US adults who use at least 1 social media tool has grown from near 0% in 2005 to 69% in 2016,[62] and there is little difference in social media use by race/ethnicity, sex, income, education, or community type. Scientists and publishers of scientific journals are beginning to recognize the potential of social media for disseminating science to the public[63,64]; however, one study found that only 15% of health researchers use social media as a dissemination tool.[64] Of the 100 most-covered 2016 journal articles, health studies were discussed on social media more than any other science topic.[65] Twitter was the most active platform for disseminating the top articles with more than 1000 tweets per article, followed by online news stories, Facebook, and blogs.[65] Social media dissemination is significantly positively associated with more downloads and eventual citations[66,67]; however, it is unclear whether tweeting science influences, or is merely correlated with, citations.[67]

Issue or policy briefs

A brief is a summary of research information in an abbreviated format, usually enhanced with charts,

tables, infographics, or some kind of data visualization that is targeted toward a specific audience and desired action.[68,69] Briefs have been used in successful advocacy efforts across public health topics, such as sugar sweetened beverage taxes[70] and active transportation.[71] The first step in developing briefs is to know your audience and tailor the information to them. Multiple studies have shown that developing relationships with those to whom you are providing information is a way to enhance the effectiveness of your brief products.[52,72] Messages within briefs should be focused, professional (not academic), and succinct.[68] Incorporating data into briefs can help define a public health problem and demonstrate the magnitude of that problem. Visuals such as tables, charts, or graphs can present data to enhance understanding and interpretation by the audience.[52] The newer approaches to data visualization (eg, infographics) help in presenting data in an accessible and appealing way to practitioners and policy makers who are often inundated with information.[73,74] It is also important to include expected benefits from what is being proposed or described. Persuading the audience to know what you want them to know and do what you want them to do should be the key objectives of the brief.[68]

One-on-one meetings

Particularly for policy audiences, one-on-one individual meetings may be an effective means by which to communicate ideas on a particular issue. Elected officials will often remember such individual meetings and consider the input that is made during these interactions. However, time constraints may sometimes render this option impractical or infeasible. Consider that most legislative bodies meet for a specified period of time with a very structured calendar—one that allows little flexibility. In preparing for an interaction with an elected official, it is often important to develop a positive working relationship with her or his legislative staffer(s). These individuals often have a great deal of influence in shaping the activities and priorities of an elected official.

Detailed guides to meeting with policy makers are available elsewhere.[60,75,76] In brief, when preparing for a one-on-one meeting with a policy maker, here are a few key pointers:

- Select a primary spokesperson if a group is meeting the official.
- Be brief, covering only 1 or 2 topics.
- Have a few pieces of key data at your fingertips that support your position.
- Provide an illustration of the program or policy impact—a human interest story often works best.

- Know precisely what action you are suggesting.
- Anticipate questions so that your answers are well-thought-out.
- Be cordial and always thank the official for his or her time.
- Follow-up with a brief note later.

Workshops and seminars

One of the main ways by which practitioners learn about research is via short courses and webinars. In multiple studies of practitioners,[49,77] the top method by which state or local public health practitioners learn about new research is via seminars or workshops. These seminars take on multiple formats from short webinars to week-long in-person trainings. While there is limited research on the most effective format,[78] several key lessons have emerged. To enhance the reach and potential for replications, train-the-trainer models show promise.[79]

The principles of adult learning are likely to be important in these seminars. These issues were articulated by Bryan and colleagues,[80] who highlighted the need to (1) know why the audience is learning; (2) tap into an underlying motivation to learn by the need to solve problems; (3) respect and build upon previous experience; (4) design learning approaches that match the background and diversity of recipients; and (5) actively involve the audience in the learning process. The endorsement from professional groups (eg, National Association of County & City Health Officials) is likely to be beneficial.

Measuring Impact

Defining and measuring the impacts of research dissemination are challenging.[81] The long-term (downstream) impacts of translating research to practice and policy involve well-known outcomes such as burden of disease (eg, mortality, potential life lost), preventable burden (eg, the product of the burden of disease and the effectiveness of intervention), and economic value (eg, incremental cost-effectiveness).[82] There are numerous "upstream" and "midstream" indicators of impact that are likely to be related in a range of complex ways to public health outcomes. While not exhaustive, Table 3 provides examples of how the results of dissemination efforts can be measured.

In the near-term, a research discovery might change public perception or awareness of public health benefits (the benefits of healthy eating) or threats (the potential impact of the Ebola virus). At an agency level, a scientific advancement might put new tools in the hands of practitioners or lead to more effective day-to-day practices (eg, use of evidence-based

TABLE 3

Sample Measures of Research Impact by Setting and Time Frame

Time Frame	Setting		
	Academic	**Practice**	**Policy**
Short-term	Publication downloads Citation rates	Awareness of an evidence-based practice Knowledge about an evidence-based practice Self-efficacy in using evidence Intentions to use evidence	Awareness of an evidence-based policy Knowledge about an evidence-based policy Self-efficacy in using evidence Intentions to use evidence
Medium-term	Citation networks Social media networks h-index scores Altmetric scores Coverage in mass media	Presence of evidence (eg, recommendations from systematic reviews) in funding announcements Use of analytic tools to inform practice	Policy maker support for evidence-based policies Presence of evidence in development of policy proposals (bills, rules, regulations) Altmetric scores Observations of use of evidence in policy-making (eg, in hearings) Narrative examples that feature scientific evidence
Long-term	Use of individual studies in systematic reviews Use of individual studies in tools for practitioners or policy makers	Uptake of evidence-based interventions Termination of ineffective interventions	Enactment of evidence-based policies Ongoing evaluation of enacted policies

interventions, leadership priority on evidence-based decision making). Scientific evidence can also be used to inform public health policy at all levels (from "small p policy" in organizations to "Big P Policy" in local, state, or national governments). In addition, a significant part of the public health mission involves public health "intangibles" (eg, social justice, health equity) that may be difficult (but not impossible) to measure.[83]

Different indicators of impact are used for practitioners and policy makers than for scientists. Researchers, especially those in academic settings, tend to value journal metrics such as Journal Impact Factor and h5-index, or author metrics such as h-index or i10-index. Article metrics have traditionally been limited to statistics such as the number of journal citations, article downloads, or views on academic social media sites (eg, ResearchGate). However, traditional journal-level and author-level metrics have been widely criticized as a poor measure of quality or scientific impact.[84,85] Furthermore, none of the traditional metrics assess dissemination of research to policy makers, the practice community, or the public at large. Consequently, researchers and publishers have turned to alternative metrics, including those offered by companies such as the aptly named Altmetric (altmetric.com). Summarizing a research article in a multicolored "donut," Altmetric aggregates mentions in outlets such as blogs and traditional online media, forums and discussion sites (eg, Reddit), social media

outlets such as Twitter and Facebook, and use of a journal article in policy documents.[86] As such, alternative metrics represent an opportunity to measure dissemination to populations more diverse than the scientific community who are closer to implementing the findings into policy and practice. Unfortunately, none of the alternative metric aggregating services are comprehensive, although adding, removing, and vetting potential sources is an ongoing process.[87]

Conclusion: Moving Our Field Forward

In disseminating their science to practice and policy audiences, public health researchers are largely doing things the way they did them several decades ago (journal articles and scientific meetings). These are important methods of dissemination and yet they do not link well with the needs and communication approaches that resonate with adopters (practitioners and policy makers). We offer several ideas that are likely to result in more effective dissemination:

- Shift the academic culture and incentives to include a greater focus on linking scientists with research users (eg, involvement in policy making and practice placements for faculty members).[45,88,89]
- Enhance expectations from funders of research for more consistent and intentional dissemination.[22]

Implications for Policy & Practice

- This review addressed the need to conduct the dissemination of research to practitioners and policy makers in new ways.

- Messages need to be framed in ways that better resonate with the target audience.

- Rather than relying only on journal articles, additional channels are needed to reach practitioners and policy makers, including the news media, social media, policy briefs, one-on-one meetings, and workshops and seminars.

- Practitioners and policy makers should advocate for and support open access journals to improve access to scientific information.

- Administrators in relevant schools (eg, medicine, public health) should consider ways to incorporate dissemination to policy makers and practitioners in tenure and promotion criteria for faculty.

- Identify and emphasize related incentives for dissemination in other organizations with a stake in dissemination (eg, creative approaches among publishers).
- Design studies in a way that emphasizes dissemination early in the research process through involvement of stakeholders.
- Track impact with metrics that focus on use of research outside of academe.

By applying these and other ideas, scientific discoveries will no longer "sit on the shelf" but will realize practice application in public health agencies and policy-making bodies.

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