

# Designing for Diffusion of a Biomedical Intervention

James W. Dearing, PhD, Dawn K. Smith, MD, MS, MPH, R. Sam Larson, PhD, Carole A. Estabrooks, RN, PhD

Dissemination must be planned and intentional or it will not occur in a systematic manner . . . And upfront planning makes all the difference.<sup>1</sup>

**D**iffusion is a social process that occurs among people in response to learning about an innovation such as a new evidence-based intervention.<sup>2</sup> Researchers have conceptualized diffusion either at the macro-sociologic level of societal sector or system and the importance of norms and associations,<sup>2</sup> the communicative level of relationships and how those patterned linkages affect adoption over time,<sup>3</sup> or the psychological level of how individuals perceive innovations in the form of a codified set of pros and cons.<sup>4</sup> Diffusion is well explained by three factors of adopters' perception of the innovation in question, adopters' perception of others' reactions and the contextual timing and framing of the innovation's introduction to its potential adopters.<sup>5</sup>

The present article applies some of what is known about diffusion to the general case of biomedical interventions and specifically pre-exposure prophylaxis (PrEP). *Designing for diffusion* is the taking of strategic steps early in the process of creating and refining an evidence-based intervention to increase its chances of being noticed, positively perceived, accessed, and tried and then adopted, implemented, and sustained in practice. For PrEP, the focus in the current paper is on healthcare providers such as physicians and nurses in primary care units, staff in sexually transmitted disease clinics and community and rural health centers, and staff in allied community-based organizations and pharmacies who serve individuals at high risk for HIV, such as young African-American men who have sex with men.

Pre-exposure prophylaxis must first be adopted by healthcare providers before it in turn can be prescribed to and tried by high-risk individuals. Many high-risk indi-

viduals for HIV in the U.S. have not traditionally had health insurance, many are not regular users of primary care, and many over-use emergency departments. Adherence to daily medication, regular and frequent testing, and behavior change will be a primary challenge for many if not most individuals at high risk for HIV. The effectiveness of PrEP is highly dependent on adherence.<sup>6</sup>

Diffusion among healthcare providers may occur because of *dissemination*, the purposive activity of intervention sponsors or developers to communicate an intervention to potential adopters. It is the elicitation of a diffusion process that is of interest when working on behalf of disseminating evidence-based interventions. This is the essence of designing for diffusion: One makes use of the tools of marketing, communication, management, and implementation science to heighten the likelihood that potential adopting service providers and implementing staff will be curious and open minded about a new intervention, willing to try it and work through obstacles to its introduction and use, and feel supported in their efforts at managing organizational change.

Pre-exposure prophylaxis, as tested in several trials,<sup>7-9</sup> is a key component in the CDC emphasis on *combination prevention*, in which several partially effective and complementary components of an intervention are delivered together to increase the likelihood of high-risk individuals not contracting HIV.<sup>10</sup> In the case of PrEP, high-risk individuals may be prescribed a combination of several components:

1. a prescribed daily oral antiretroviral medication;
2. regular HIV testing to monitor for infection;
3. care coordination;
4. condoms;
5. sexual risk-reduction counseling and education materials;
6. substance-abuse counseling;
7. medication-adherence counseling; and
8. ongoing monitoring for, and management of, medication side effects

Efforts to effectively disseminate and implement PrEP will need to integrate "PrEP packages" of combination prevention components in clinical and allied organizations. This level of complexity is a barrier to PrEP diffusion among service providers. Yet it is the case that many

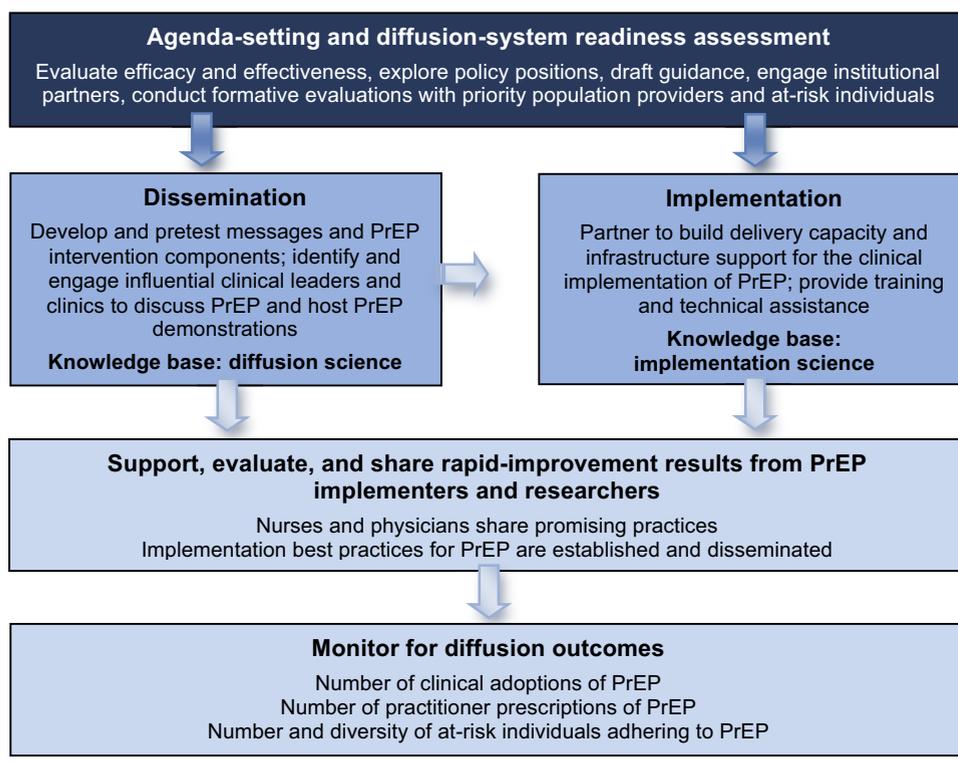
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From the Center for Health Education Dissemination and Implementation Research (Dearing), Kaiser Permanente, Diffusion Associates (Larson), Denver, Colorado; the National Center for HIV/AIDS, Viral Hepatitis, STD and TB Prevention (Smith), CDC, Atlanta, Georgia; and the Faculty of Nursing (Estabrooks), University of Alberta, Edmonton, Alberta, Canada

Address correspondence to: James W. Dearing, PhD, Center for Health Education Dissemination and Implementation Research, 10065 E. Harvard Avenue, Suite 300, Kaiser Permanente, Denver CO 80231-5968. E-mail: james.w.dearing@kp.org.

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**Figure 1.** Designing for the diffusion of PrEP  
PrEP, pre-exposure prophylaxis

adopting providers will have ongoing responsibilities with HIV and STD prevention as well as established outreach with high-risk individuals who will be appropriate candidates for PrEP. So even while PrEP necessitates a mix of intervention components for any one individual, potential adopting providers who have experience with the complexity of high-risk individuals' lives may be skeptical of interventions that seem too simple (i.e., perceived complexity for some innovations can be positively rather than negatively associated with adoption).<sup>11</sup>

### Four Phases to Designing for Pre-Exposure Prophylaxis Diffusion

The current paper describes four phases associated with designing for diffusion that characterize successful introduction and scale-up of evidence-based interventions. The activities (Figure 1) can occur simultaneously and recursively:

1. agenda setting, which includes partnership engagement, issue framing, and timing of the introduction of an intervention to potential adopters;
2. dissemination and distribution, which can result in heightened awareness of an intervention and access to materials and services;
3. engagement of well-connected people who are influential in the community, whose trustworthiness and expertise

serve as social confirmation to potential adopting organizations that an intervention should be tried; and

4. implementation of the intervention into practice settings, which occurs through localized learning of how to best adapt the intervention and practice conditions so that the intervention can be exploited for maximum benefit to patients and with minimized operational cost to provider organizations.

### Phase 1: Agenda-Setting and Assessing System Readiness

The *agenda-setting process* is an ongoing competition among issue proponents to gain the attention of

media professionals, the public, and key stakeholders. An issue proponent is a person with the ability to draw attention to an issue such as HIV. Proponents may include scientists, but they are more typically association leaders and nongovernmental organization leaders. Issue proponents may emphasize a particular innovation within an issue domain, such as PrEP, as one response to HIV.

A key means by which proponents seek to help set the agenda is through framing the issue at hand. *Framing* is the association of particular meaning with an issue.<sup>12</sup> Contention among issue proponents often concerns the framing of an issue. Which frames are most positively perceived by key constituencies? For example, are innovations in HIV prevention best understood as societal advances, shared economic costs, personal choices, or ethical decisions? Should PrEP be portrayed as part of a "third wave" of HIV prevention?<sup>13</sup> These are empirical questions that can be answered through discussions among representatives of partnering issue proponents and formative research with representative members of key constituencies. The frames that dominate media coverage and public opinion of an issue affect the perceived salience of the issue<sup>14</sup> and can affect the overall attention given to an issue such as HIV.<sup>15</sup>

As the health impact science of PrEP continues to emerge, the responsibility for drawing media and public attention to PrEP with a positive frame falls to a variety of

academic, health systems, and community organizations that are involved in studies of intervention effectiveness, explorations of financing and regulatory approval and ethical considerations, and trying new models of integrating primary care with public health. In addition, communicating the developing understanding of the health impact of PrEP to engaged communities will fall to several types of nonfederal and federal organizations that facilitate the participation of community stakeholders.<sup>16</sup> The specific roles of the various types of organizations will differ. Attempts to generate attention to an innovation such as PrEP should co-occur with attempts to renew attention to the more general issue of HIV prevention. For PrEP to rise in salience and persist on health agendas, it must offer issue proponents a means to again draw attention to the more general issue of HIV prevention and at the same time redefine the more general HIV prevention issue.<sup>17–19</sup>

Idea champions have a particularly critical role to play in spreading information and evaluative judgments about PrEP within and among highest-incidence communities, especially among providers in those communities. These idea champions bridge these and other types of peer networks, and they function to exchange best practices in HIV prevention nationally and internationally.<sup>20</sup> Idea champions communicate an idea such as PrEP in private conversations with high-level stakeholders in personal discussions office by office, community by community.<sup>21</sup> The result of agenda-setting activity is a “go/no go” decision by issue proponents to proceed in preparing for dissemination, or not.

## Phase 2: Preparing for the Dissemination and Distribution of Pre-Exposure Prophylaxis

The objective with dissemination of information and distribution of products and services is that the supply of each component of combination prevention will be scaled up and easily accessible so that provider and patient demand for PrEP, if realized, is met with health system supply.<sup>10,22</sup> Uncertainty among primary care providers about PrEP should be addressed through a variety of channels of communication. Descriptive information and content that helps potential adopting healthcare providers with initial understanding of PrEP should be provided through clinic and public health office–targeted social media and websites. These formats can be accompanied by small media handouts such as provider checklists of key questions to ask high-risk individuals for whom PrEP is being considered, as well as informational brochures for them. YouTube clips of effective discussion about PrEP with high-risk individuals and telephone hotlines to provide practice advice to clinicians also can be provided.

Journalists can play a valuable function in writing feature stories about at-risk individuals, their shared decision making with clinicians, and how they decided whether PrEP was or was not the right choice. Portraying examples of high-risk individuals for whom PrEP was not a good choice is important, too. After all, the objective is not just greater provision of PrEP; it is reaching the appropriate people, with adherence and continued testing.

For healthcare providers as well as high-risk individuals, PrEP will be perceived through the lens of practical and important concerns about cost,<sup>23</sup> side effects, and regularity and ease of use.<sup>24</sup> For busy clinicians, the pros and cons associated with PrEP will be complicated with issues related to their practice setting: Does PrEP require considerable additional time and are they well staffed for what it requires? Who will be responsible for coordination across departments? Who on the healthcare team will do what? How complicated is reimbursement going to be? Will high-risk individuals be successful in adherence or will provider energy be consumed in follow-up reminders, check-ins, and client and patient prompts? It is likely that these possible barriers will be very similar to those found in primary care and community clinic settings for routine HIV screening and enhanced HIV testing.<sup>25,26</sup> Clinic-based demonstrations, in which the hosting clinics are purposively selected in part because of their credibility as perceived by peers at other clinics, can be effective in providing convincing answers to difficult questions about implementation.

Diffusion studies show that personal evaluations of new interventions such as PrEP are likely to be made on the basis of perceived innovation attributes. Marketing and management scholars have made similar observations.<sup>4,27,28</sup> These attributes, listed below, function as barriers and facilitators to diffusion.

**Compatibility of pre-exposure prophylaxis.** When adoption decisions are voluntary, the perceived compatibility of the intervention with the potential adopter's values, past experiences, and needs is of particular importance. Provider adoption is more likely when an intervention is compatible with the ways in which the provider thinks and behaves already. Perceived compatibility is explicitly relative; it is a cognitive match that the potential adopter determines between the innovation, on the one hand, and the context of use, on the other.<sup>29</sup> Can provision of PrEP be done in a way that does not disrupt the existing workflow? Will enough of an organization's clients or patients be good candidates for PrEP in terms of daily dosing, adherence, safer sex behaviors, safety, and regular visits? Ideally, information dissemination about PrEP will be fashioned in such a way that providers can

see how it can be delivered in ways that are compatible with their current work environment.

**Costs of pre-exposure prophylaxis.** The extent to which potential adopters perceive an intervention to be less expensive than current means of achieving an objective, or to have short-term costs that are very considerably less than potential long-term costs if prevention efforts fail, is an important predictor of adoption. Cost is measured broadly as resources incurred or not including time, money, and staffing, as well as resources such as reputation or social capital. Because of PrEP's high medication cost, the service resources devoted to risk-behavior change and medication-adherence support, its requirement for regular clinic visits for HIV testing and laboratory monitoring, and a resulting need for insurance reimbursement for many clients and patients, PrEP presents a complicated and difficult set of cost barriers. The perceived costs of PrEP will need to be better understood and addressed in creative ways for this intervention to diffuse effectively.

**Simplicity of pre-exposure prophylaxis.** Evidence-based interventions often are not adopted because they are too difficult to understand, or too complex to use. Perceived simplicity is, like compatibility and cost, a key attribute in studies of prevalence of adoption. For potential adopters to develop a positive attitude toward the intervention, operational complexity must be managed so that adopters perceive that they understand the innovation and that they can use it. Brief, simple reminders, behavioral cues, and decision aids for PrEP will need to be developed and distributed to assist service providers and their high-risk clients and patients.

**Effectiveness of pre-exposure prophylaxis.** Scientists and those responsible for communicating science to the public often emphasize evidence of effectiveness in designing messages to be disseminated. Although important stakeholders such as local opinion-leading physicians often do consider carefully evidence of effectiveness for innovations, the majority of adopters usually weigh compatibility, cost, and simplicity at least as heavily in their adoption-decision processes.

**Observability of pre-exposure prophylaxis.** When the positive results of using an intervention can be seen clearly, adoption is more likely. Observability has more to do with seeing and remembering anecdotal cases of high-risk individuals doing well in adherence or doing poorly than it does with printouts of statistical results that document success. Developing narratives for websites and video vignettes for distribution to potential adopting healthcare providers that show clients and patients benefiting and that show how nurses and physicians have

incorporated PrEP into their work are ways to use observability to stimulate adoption.

**Trialability of pre-exposure prophylaxis.** The extent to which a potential adopter can experiment informally with an intervention before an adoption decision is weakly and positively related to adoption. An intervention that can be tried on a temporary basis without negative repercussion, or an intervention that trial-adopting staff can phase in gradually or in part, reduces the uncertainty that is associated with adoption and the commitment it often entails. Clinics could, for example, be encouraged to begin with a small number of high-risk individuals on PrEP so that staff can observe and adjust the timing of visits and patient flow and assess the adherence challenges and referral process and the difficulty of tracking and staying in communication with individuals who traditionally have not been regular clients of health care.

### Phase 3: Engaging Social Influence for Pre-Exposure Prophylaxis

As individuals get closer to making an adoption decision about a consequential intervention, they are past the point of needing information about the intervention. Instead, they transition to looking for a form of “social proof”—evidence that others too think the intervention is a good idea. Clinical leaders will look to other clinical leaders. Are their peers adopting it, delaying a decision, or rejecting it?

Social influence can be measured, assessed, and used for intervention purposes. For healthcare providers, informal opinion leaders about new clinical approaches to HIV prevention are likely to be work closely with colleagues in the same or a similar organization, in the community. But, of course, individuals are at times influenced by others they do not know personally. Impersonal social influence includes spokespeople in medical media and the influence they can have on healthcare leaders and providers and, for high-risk individuals who may inquire about PrEP or begin a PrEP regimen, celebrities and the influence that their mediated attitudes and behaviors can have on audiences that attend to them. For PrEP dissemination, both personal and impersonal social influence can be useful.

Knowledge of social influence can help PrEP planners make decisions about which organizations are key for influencing the PrEP-adoption decisions of healthcare organizations and providers. Whether such data are collected through informant interviews, sociometric surveys, archival records, or on the basis of observation, such data can help PrEP planners identify influential healthcare organizations that leaders and staff in other area

organizations will recognize as credible. These forms of data collection, which can be used singly or in combination, are each actionable at the level of interorganizational networks of healthcare providers serving high-priority communities.<sup>30–32</sup>

Social influence intervention of this sort is a reason why designing for diffusion can be efficient: An intervention source or sponsor can spend special attention to a special small subset of all possible adopting organizations to encourage intervention diffusion as long as (1) potential adopter attitudes are favorable toward the new practice and (2) others identify the opinion leader positively with the intervention.<sup>33</sup> Alternatively, and indeed more commonly, when influential people have a low opinion of an intervention, it is their avoidance of it (passive rejection) and/or their opposition (active rejection) that impedes its spread.<sup>34</sup>

#### Phase 4: Implementing Pre-Exposure Prophylaxis

Effective implementation of PrEP in clinical care settings will necessitate preparatory work, ongoing monitoring, evaluation, and technical assistance, and continuous quality-improvement strategies to incorporate PrEP as standard of care for high-risk individuals and to deliver PrEP efficiently and safely without creating undue burden on healthcare systems. The current paper highlights the importance of gathering quantitative and qualitative feedback about the progress and quality of implementation to be shared at the clinic level during regular debriefings about progress and experience.

During initial piloting of PrEP, a plan–do–study–act or continuous quality-improvement approach<sup>35</sup> could be considered a means of reflection and evaluation. PrEP warrants close attention to monitoring. Surveillance of public health and clinical practices and client and patient outcomes is critical to show the value of PrEP and to suggest process improvements for greater effectiveness. This may require tying PrEP data collection to other surveillance activities and/or working with Federally Qualified Health Centers and other healthcare facilities in the tracking of clients and patients, perhaps through electronic medical records and/or registries.

Early engagement of people who are critical to implementation is essential. For example, conducting interviews and/or focus-group discussions with providers before introduction of an intervention can help identify potential and perceived barriers and facilitators toward implementation and thereby highlight issues that need to be addressed before or during the implementation process. In addition, by involving providers early and responding to their expressed needs and concerns, implementation planners can increase buy-in, sup-

port, and interest in provision of PrEP, which then can improve substantially the likelihood of effective implementation.<sup>36,37</sup>

#### The Key to Designing for Diffusion: Triggering Demand

Activating agenda setting, dissemination and distribution, social influence and implementation rely on the provision or “push” of knowledge and tools, motivation or “pull” among practitioners to try an innovation, and healthcare and public health infrastructure for linking the two.<sup>38,39</sup> Knowledge is conceptualized as moving in relation to push factors from the knowledge production/supply side, and pull factors from the knowledge use/demand side. The integration of healthcare provider needs and wants (pull) with research-generated knowledge (push) can result in value-added utilization.<sup>40</sup> For example, creating an online discussion board for populations targeted for PrEP delivery (e.g., young men who have sex with men) is a push activity; formatively testing the discussion-board format, content, and management with intended users and incorporating that feedback into the redesigned discussion board embeds pull into the push activity.

A sole emphasis on making information available and accessible (push) or only focusing on the stimulation of demand (pull) without then being able to satisfy that demand through an available distribution system (the infrastructure) is unlikely to effectively bridge research–practice gaps.<sup>41</sup> Organizational capacity building, training, and technical assistance are important parts of developing and supporting systemic capacity for PrEP delivery, but so is policy agenda setting, selecting clinical sites through readiness assessments and, critically, “making the business case” for why an innovation is beneficial to an organization, its service providers, and its clients or patients.<sup>42</sup>

Eliciting demand is the critical part of this model.<sup>43</sup> In all its forms, pull reflects the felt motivations<sup>44</sup> of potential adopters such as clinical decision makers and their staff. Some motivations are more extrinsic in their reward to the individual or organization, such as insurance companies agreeing to reimburse clinics for the costs of providing PrEP, or quality-assurance organizations recognizing PrEP as evidence-based care. Other motivations are more intrinsic. The potential adopter thinks and behaves certain ways because she wants to; she evaluates PrEP in terms of its pros and cons in relation to what else she personally knows and experiences; she seeks the opinions of others about PrEP and assigns credibility because she values them.

## Conclusion

Although more basic research about PrEP certainly is needed, especially about long-term effectiveness and intermittent dosing,<sup>45</sup> PrEP is now available for consideration by healthcare providers and individuals at high risk for HIV. Designing for diffusion can be applied to PrEP by conceptualizing healthcare providers and their organizations as potential adopters to encourage the consideration of its appropriate use. This evidence-based approach to planning, dissemination, and implementation is based in protocols and tools from marketing, communication, management, and implementation science that, when applied early to the phases of agenda setting, dissemination and distribution, identification and engagement of well-connected influentials, and implementation, can heighten the likelihood of a positive consideration of an intervention such as PrEP.

The authors recommend the following:

1. The framing of PrEP should be considered an opportunity—if supported by formative evaluation with stakeholders—to recast the larger issue of HIV prevention in a new era of primary care–public health partnership.
2. Based on stakeholder involvement and feedback, messages should be developed about PrEP that proactively address it in terms of the six innovation attributes of perceived compatibility, cost, simplicity, effectiveness, observability, and trialability.
3. PrEP should be used as an opportunity to demonstrate and showcase new forms of primary care and public health integration at the community level in which disparate organizations coordinate prevention activity on behalf of high-risk individuals.
4. High-incidence communities should be priority sites for identifying informally influential healthcare organizations and providers and intervening with them in high-level discussions about PrEP.
5. Because of the likelihood that many individuals at high risk for HIV will be unfamiliar with routine clinic appointments, and may drop into and out of communication with their providers, examples of successful coordination of prevention across organizations should be modeled and communicated to leaders in public health and healthcare organizations.
6. Targeted outreach to providers should be supported with ready supplies of the prevention resources that constitute combination prevention.
7. Targeted, “small media” communication campaigns to reach high-risk individuals should be introduced to stimulate the interest of high-risk individuals.
8. A web-based means for implementing staff at healthcare organizations to learn of others’ promising practices in

delivering PrEP, and allow for the uploading of clinical experiences, should be established and supported.

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