NCI's Dissemination and Diffusion Administrative Supplement Program: Lessons Learned and Recommendations

Erin Eckstein
Presidential Management Fellow
Implementation Science
Division of Cancer Control and Population Sciences
National Cancer Institute
February 2012

Executive Summary

Prior to participating in the Trans-NIH PAR Dissemination and Implementation Research in Health, the National Cancer Institute (NCI) supported dissemination and implementation (D&I) research through the Dissemination and Diffusion Supplements program. This administrative supplement program provided small, short-term awards between 2002 and 2008 to existing NCI grantees engaged in cancer control research. With the funds made available by the supplements, grantees were able to more broadly disseminate cancer surveillance findings, or to implement cancer control interventions in additional settings. As these grantees are some of the early pioneers of dissemination and implementation research, lessons learned from their experiences may be useful both to future D&I researchers and to the NCI.

This analysis, conducted in the fall of 2011, details these lessons learned. The analysis collected data from several sources, including grantee publications, progress and final reports to the NCI, NCI administrative data, as well as informal follow-up conversations with grantees. The first part of the analysis describes the research conducted via the supplements, classifying the work along the diffusion-implementation continuum. The theories, methods and strategies utilized by the supplements are also described.

Next, the analysis presents the typical challenges encountered by researchers as they conducted D&I research. Most challenges involved unanticipated delays, as performing research in the real world means that researchers have less control over the settings in which they work. As a result, researchers recommended flexibility, as the procedures and protocols of the parent trial research had to be adapted to fit in to these settings. Despite these challenges, supplement grantees indicated a number of successes including changing the standard of care at a health care organization, providing an evidence base for legislative change, changing a health care organization's orientation toward vulnerable populations, developing strong community partnerships, and using the supplement to develop additional grant applications.

To achieve success, the supplements utilized a number of common strategies including purposefully designing interventions and tools to integrate as seamlessly as possible in to already existing systems. The importance of developing trusting partnerships with collaborating organizations was also a common theme, as well as conducting research that was perceived as valuable and useful by the partner organization. Patience and careful planning were recommended by the researchers to develop these partnerships and conduct the D&I research.

The analysis yielded a number of recommendations for NCI. These recommendations are to:

1. Promote the Trans-NIH Dissemination and Implementation Research in Health funding opportunity to supplement grantees

2. Continue to promote the multi-disciplinary nature of D&I research by encouraging linkages with the methods and frameworks of other relevant fields

3. Investigate methods to facilitate technical assistance and other means to disseminate interventions more actively and widely

4. Continue to define and develop the various outcomes of D&I research and a D&I research program, as well as the methods to measure and evaluate them

It is hoped that the advice and lessons learned from early D&I researchers may be useful to their contemporaries. In particular, their recommendations for developing user-centered tools and systems, creating strong partnerships, and engaging in sufficient planning may help other researchers to develop strong D&I studies. The findings of this analysis also have implications for the way NCI might continue to support D&I research, by improving communication with researchers, establishing linkages with related fields, encouraging the study of methods to provide technical assistance, and developing new approaches to evaluation.

Introduction

Scientific investigation has devoted increasing attention to the dissemination and implementation (D&I) of health research knowledge. While basic scientific discovery is important, translating basic discovery to practice and policy is ultimately what leads to improved population health[1]. Dissemination and implementation is the study of this process of integrating research, practice, and policy. Important questions remain about the frameworks, methods, and outcomes of this nascent field. Nevertheless, dissemination remains an important component of the National Cancer Institute (NCI), as codified in Public Law 92-218.

Between 2001 and 2005, NCI created the Dissemination and Diffusion Supplements to fund the dissemination, diffusion, and implementation of cancer control intervention research products. In 2006, the focus of the supplements shifted from dissemination, diffusion and implementation of intervention products to a focus on surveillance research. Between 2002 and 2008, this program awarded one year administrative supplements of approximately $100,000 to $220,000 in total costs to investigators with active parent research grants (R01s), program project/center grants (P01s), and research project cooperative agreements (U01s). Since dissemination of *evidence-based* intervention research and surveillance products was critical to the program, applicants were required to provide data and analysis from the parent grant justifying dissemination. Because the focus was to support the application of findings to real world problems, investigators were encouraged to use methods in addition to the randomized controlled trial (RCT). Funded projects are listed in Appendix 1.

Investigator interest in the Dissemination and Diffusion Supplements laid the groundwork for NCI's collaboration, beginning in 2005 and continuing to the present, in the Trans-NIH R01, R03 and R21 grants[i] supporting Dissemination and Implementation Research in Health (DIRH). Lessons learned from the pioneering supplement work in cancer control D&I research may provide valuable lessons for future investigators, as well as insight in to the ways that NCI might support current and future research.

This analysis, conducted between October and December 2011, describes the types of research conducted through the supplement program and their conceptual frameworks. Additionally, this analysis examines the participation of supplement grantees in other NCI D&I

[i] http://grants.nih.gov/grants/guide/pa-files/PAR-10-038.html, http://grants.nih.gov/grants/guide/pa-files/PAR-10-039.html, http://grants.nih.gov/grants/guide/pa-files/PAR-10-040.html

initiatives. Finally, while the supplements encouraged alternatives to the RCT, results from RCTs are often how findings are reported in academic journals; the impact of these articles and findings can be assessed through later citations via bibliometric analysis. In the case of dissemination and implementation, however, impact is defined more by practical changes in real world settings, which may not be reported in the academic literature. This analysis seeks to identify and understand these changes, how they occurred, and what can be learned from them.

A Note on Definitions

In any evolving field, there are competing definitions for key terms. In the case of D&I, diffusion, dissemination and implementation have varying and subtly different meanings. The Implementation Science team at NCI utilizes the terms presented in Table 1. The Trans-NIH PAR makes a distinction between dissemination and implementation research as seen in Table 2. As they were issued early in the NIH funding process for D&I research, the funding notices for the Dissemination and Diffusion supplements did not articulate definitions, but rather listed the types of research that were encouraged, as seen in Table 3.

Table 1. The Diffusion-Dissemination-Implementation Continuum[ii]

Diffusion	Dissemination	Implementation
1. Research diffusion …the passive process by which a growing body of information about an intervention, product, or technology is initially absorbed and acted upon by a small body of highly motivated recipients.[2]	**1. Research dissemination** …active process through which the information needs (pull) of target groups working in specific contexts (capacity) are accessed, and information is "tailored" to increase awareness of, acceptance of, and use of the lessons learned from science.[4]	**1. Research implementation** …the utilization of strategies or approaches to introduce or modify evidence-based interventions within specific settings. This involves the identification of and assistance in overcoming barriers to, the application of new knowledge obtained from a disseminated message or program.[2]
2. Diffusion research …centers on the conditions which increase or decrease the likelihood that a new idea, product, or practice will be adopted by members of a given culture.[3]	**2. Dissemination research** …the study of processes and variables that determine and/or influence the adoption of knowledge, interventions or practice by various stakeholders.[5]	**2. Implementation research** …research that supports the movement of evidence-based interventions and approaches from the experimental, controlled environment into the actual delivery contexts where the programs, tools, and guidelines will be utilized, promoted, and integrated into the existing operational culture.[6]

Table 2. Definitions of Dissemination and Implementation in the Trans-NIH DIRH PAR

Dissemination	Implementation
The identification of mechanisms and approaches to	The scientific study of methods to promote the

[ii] Available at http://cancercontrol.cancer.gov/IS/definitions.html

package and convey the evidence-based information necessary to improve public health and clinical care services.	integration of research findings and evidence-based interventions into healthcare policy and practice; the study of "how" interventions are transported to real-world practice settings.

Table 3. Examples of the Research Encouraged by the Dissemination and Diffusions Supplements

Dissemination/Diffusion of Surveillance Research	**Dissemination/Diffusion of Behavioral Research**
Test strategies for applying data to cancer control programs, practice or policy across the cancer continuum	Diffusion of interventions to populations/settings broader than those from which the original intervention was drawn
Communications research to package surveillance data to tell the most compelling stories	Cost-effectiveness evaluations
Improve strategies for the dissemination of surveillance research tools and data	Qualitative or quantitative research to support the adaptation of intervention to new settings/populations

Analytical Approach

Analysis of the Dissemination and Diffusion Supplement program consisted of several steps, involving three data sources. Overall, there were 20 funded supplements, with 19 individual projects conducted by 18 investigators.

Document Review

All Dissemination and Diffusion Supplement applications were retrieved through the Division of Cancer Control and Population Sciences Portfolio Management Application (PMA) tool and eGrants, both NCI grants management software. Information about the supplements' specific aims, focus areas, conceptual frameworks, and plans for analysis was extracted. Second, materials documenting the results of the supplements, in the form of reports or peer-reviewed articles, were retrieved, when available. Thirteen projects published articles in academic journals to report the findings or results of their D&I efforts. Some articles presented findings from the supplement as a whole, while others presented findings from formative research done to support the project. Seventeen projects submitted a report to NCI summarizing their progress towards completing their aims, though there was tremendous variation in the results, level of detail, and analysis provided. Finally, investigators were contacted via email to determine if any supplemental materials were available. Submitted supplemental materials included conference presentations, posters, project stakeholder feedback, and a draft outline for an article. The documents collectively provided information on results of the supplements, achievement of

research aims, lessons learned about the process of performing dissemination and implementation, and the types of challenges encountered by researchers.

Informal Discussions

Investigators were invited to participate in an individual follow-up discussion, in which nine participated. Discussion questions sought to illuminate the process and context of dissemination and implementation: challenges faced by investigators, key achievements, lessons learned, the process of adapting research to the "real world", and experiences working with stakeholders. The questions also sought to determine investigators' current engagement with D&I research. The list of questions is available in Appendix 2. Notes from the telephone discussions were recorded, coded and organized based on emerging themes.

Administrative Data

Examination of administrative data determined if grantees were connected to current NCI D&I initiatives. Supplement grantees involved in behavioral research were required to submit their parent grant intervention for consideration to Research-tested Intervention Programs (RTIPs), a repository of evidence-based intervention programs. The repository is an integral component of Cancer Control P.L.A.N.E.T. (Plan, Link, Act, Network with Evidence-based Tools), a web portal designed to help state and local cancer control planners, program staff, and researchers to design, implement and evaluate evidence-based cancer control programs. RTIPs was examined to determine if the intervention had been accepted. Second, it was hoped that investigators' experiences with the supplements would stimulate proposals in response to the Trans-NIH DIRH announcements. Information from PMA was retrieved to determine if grantees had applied for and been awarded funding under the DIRH PAR.

Results

Classification of D&I Projects

Of the 20 supplements, twelve disseminated or implemented behavioral interventions that addressed a number of cancer risk factors or preventive behaviors. The remaining 8 diffused or disseminated cancer surveillance research to new audiences, often by creating new tools to facilitate the transfer of information. Of the nine investigators who participated in follow-up discussions, five disseminated behavioral interventions and four disseminated surveillance research findings. A simple classification of the types of research disseminated by the supplements and their corresponding topic areas is presented in Tables 4 and 5.

Tables 4 and 5. Dissemination and Diffusion Supplement Topic Areas

Behavioral Supplements (12)	
#	**Topic Area**
5	Smoking Prevention or Cessation
3	Fruit and Vegetable Consumption
3	Cancer Screening
1	Sun Safety
12	**Total**

Surveillance Supplements (8)	
#	**Topic Area**
4	Breast Cancer (mammography, surveillance, quality of care)
2	Tobacco control
1	Indoor tanning
1	Geovisual presentation and analysis of cancer data (applicable to a variety of cancer types)
8	**Total**

The conceptual frameworks utilized by the projects can be seen in Table 6, and include the pioneering D&I frameworks Diffusion of Innovations, RE-AIM, and PRECEDE-PROCEED.

Table 6. Models and Frameworks Utilized by Dissemination and Diffusion Supplements[iii]

D&I Model or Framework	**# of Supplements**
Diffusion of Innovations[3]	12
RE-AIM[7]	4
PRECEDE-PROCEED[8]	3
Explicit blending of Diffusion of Innovations with Transtheoretical Model of Behavior Change[9,10]	2
Community Based Participatory Research[11]	1
Practical Clinical Trial[12]	1
Push-Pull[13]	1
Public Health Advocacy Framework, Public Attention Cycle[14,15]	1

[iii] These theories, models and frameworks are not mutually exclusive, as a grantee might employ both Diffusion of Innovation and RE-AIM.

Table 7 presents a classification of the Dissemination and Diffusion supplement projects based on the distinctions between dissemination and implementation currently utilized by the Trans-NIH DIRH PARs.

Table 7. A Typology of Dissemination and Implementation Research in the Dissemination and Diffusion Supplements

A Typology of Dissemination and Implementation Research			
Dissemination Research		**Implementation Research**	
Research Objective	**# Supplements**	**Research Objective**	**# Supplements**
Dissemination of surveillance data, tools, or models to advocacy groups, health planners, or public health professionals	5	Implementation of an evidence-based intervention/program to broader settings	7
Dissemination of surveillance data, tools, or models to medical practitioners	3	Dissemination of best practices (infrastructure and tools) for implementation of emerging evidence-based programs	1
Dissemination of materials or information about an intervention to broader settings/systems	4		
Total	**12**	**Total**	**8**

Table 8 illustrates the methods and strategies used by the supplement project to achieve dissemination and implementation.

Table 8. Methods and Strategies of Dissemination and Implementation

Dissemination Research Methods	**Implementation Research Methods**
Dissemination of surveillance data, models or tools to advocacy groups, health planners, or public health professionals • Interpersonal communication channels and trainings • Interactive websites or portals allowing varying degrees of user-input • Strategic press releases and media pieces • Predictive models tailored to the needs and realities of local populations	**Implementation of an evidence-based intervention/program to broader settings** • Experimental, quasi-experimental, and fidelity evaluations to compare implementation to the original trial • Training, technical assistance or toolkits • Targeted communication materials utilizing Diffusion of Innovations concepts • Formative research to assess barriers or facilitators to implementation
Dissemination of surveillance data, models, or tools to medical practitioners • Interactive websites • Formative research to assess practitioner attitudes and beliefs to develop tools, support	**Dissemination of best practices (infrastructure and tools) for implementation of emerging evidence-based programs** • Recommended organizational best practices with a tool kit

dissemination, or encourage participatory processes	
Dissemination of materials or information about an intervention to broader settings/systems • Targeted communication materials emphasizing compatibility, relative advantage and other Diffusion of Innovations concepts • Community Opinion Leaders and testimonials to encourage adoption of the innovation • Integration in to the target organization's existing communication channels • Academic detailing, conferences, peer-reviewed and popular press articles	

Participation in other D&I Initiatives

Examination of RTIPs revealed that three of twelve behavioral interventions were included in the repository. Supplement grantees submitted three applications to the Trans-NIH DIRH PAR. One of these applications was funded, and two were administratively withdrawn. Most investigators who participated in the informal discussions were unaware of the opportunity.

Defining Successful Outcomes

Many grantees observed that the supplements limited what could be achieved; one year and $200,000 was simply too little. Several grantees acknowledged that, in retrospect, their aims were overly ambitious given the unanticipated challenges they encountered. In addition, given that RCT results and bibliometric analysis may not be appropriate measures by which to assess D&I projects, other definitions of success must be considered.

Grantees encountered numerous and varied unanticipated challenges. For example, several implementation sites for one project were closed during the project, as these community health clinics were facing severe financial constraints. Other grantees faced changes either in the personnel or the organization of their partner sites, meaning that established connections were lost and had to be re-built. In one case, the project encountered unforeseen resistance by the partner staff and eventually had to withdraw from the site and recruit a new one. Projects that implemented tested interventions in new settings usually engaged in staff training or technology transfer, which, due to staff turnover, required booster sessions. For some, the transfer of technology or information systems proved to be more complicated, expensive, and time-consuming than expected. These investigators quickly discovered that staff at the implementing

organizations were stretched thin, overburdened with competing priorities and responsibilities. As such, implementation and evaluation of the proposals took more time than expected, and in some cases meant that not all study aims were achieved. While the specifics of all these challenges are varied, the overarching lesson is that dissemination and implementation research in real-world settings must address a variety of factors which simply do not appear in the tightly controlled research environments of clinical trials. All these factors mean that considerable time is needed to carry out a successful D&I effort.

Among those performing implementation research, acknowledging that the "real world" is messier than traditional research environments led many investigators to make a number of adaptations and refinements to the original parent trial intervention. As a result, they experienced the fundamental tension[16] between adaptation and fidelity, between assuring external versus internal validity. Often these adaptations led to decreased efficacy of the intervention. In one project, for example, a no-contact control group was deemed unethical by the partnering organization and eliminated. A decrease in intervention efficacy was therefore unsurprising since the control was receiving the intervention. Another researcher discovered that one intervention component was ineffective in the implementation trial, even though it had been proven efficacious in the parent trials. The researcher suggests that poor implementation of this particular component may explain the failure, as the implementers were not monitored for fidelity and may have lacked confidence or skill. Others made adjustments to recruitment and follow-up procedures, leading to more heterogeneous samples and lower intervention doses. Finally, one investigator found that implementing organizations rarely wanted to implement the entire intervention package, but instead chose the pieces most suitable for their organizations.

Despite the myriad challenges and short time frame, investigators were able to achieve success in a number of ways, as listed in Box 1. Two investigators found that the supplements created "bang for the buck"; small projects with limited funding led to considerable change. For example, one investigator suspects that her surveillance work and collaboration with advocacy organizations facilitated the passage of a new state law. Another notes that the small amount of supplement funding supported the dissemination of one health promotion program, and then led to the creation of an entire health and wellness initiative. Two researchers demonstrated that achieving high cancer screening and follow-up rates among minority and low-income patients was possible; health care organizations could be held accountable for ensuring patients are up to

date. Both of these interventions have been considered as potential quality improvement strategies to be implemented system-wide. Another investigator acknowledged that the tools her project developed had applicability to a variety of other cancer sites, and therefore the potential for further dissemination. Finally, one investigator was able to change the standard of care at a health care organization by disseminating an efficacious, cost-effective intervention.

The four surveillance researchers who participated in follow-up discussions disseminated their surveillance findings through websites, web portals, or web-based tools. Most of them noted that maintaining these websites in the face of evolving technology, ever newer research findings, and no additional financial support is nearly impossible. One investigator has been able to maintain the site, while two others have found potential external adopters to support the site.

Box 1. Achievements of the Dissemination and Diffusion Supplements

- Bang for the buck: relatively small projects can lead to considerable change
- Research used to support legislative change
- More accountable health care organizations that successfully reach disadvantaged populations
- Standard of care changed in a large health care organization through an efficacious AND cost-effective intervention
- Intervention considered as a quality improvement strategy to implement system-wide
- Potential for sustainability; found potential external partners to support the disseminated innovation beyond the original funding provided by NCI
- Tool is applicable to other fields and systems
- Development of strong community partnerships
- Training of future practitioners/Transfer of knowledge
- Reached target audience
- Used supplement to inform a larger grant proposal

How to Achieve D&I: Tools, Teamwork, and Tenacity[17]

In other research, an organizational intervention for primary care practices to increase the provision of preventive services found a synergistic set of characteristics which contributed to practice change: tools, teamwork and tenacity. These characteristics were echoed in the work of the Dissemination and Diffusion Supplements.

Tools. An overwhelming theme from the analysis was the necessity of creating *user-centered* tools and systems. Many of the web-based tools disseminating surveillance research adopted an explicit user-centered focus, tailoring content to specific audiences or allowing users to upload their own data or tools. Those disseminating interventions in to new settings found ways to adapt their interventions, as discussed above, to partner organizations so that they could be more easily integrated. For example, one investigator made changes to a patient tracking system, a key component of the intervention, to be more useful to the implementing organizations. Another investigator embedded the dissemination and its evaluation within systems already existing within the partner organization, while another altered the originally-tested innovation by adopting the partnering organization's recruitment system. In these cases, investigators developed or adapted tools that were seen as useful and usable by partnering organizations.

Teamwork. Strong partnerships were a key to the success of the dissemination and implementation efforts. Some grantees worked with partners with whom relationships had been established over the course of years, if not decades. One researcher cautioned that strong relationships do not necessarily depend on the length of time, but rather the trust and commitment that evolves over a long period. Investigators recommended aligning the dissemination with recognized needs or priorities of the partner organization; in some cases, it is necessary to do formative research to determine these needs. Dissemination for the sake of dissemination was not advisable. That is, the disseminated intervention or research findings had to solve a problem or satisfy a need faced by the organization or target audience. For example, in one case the dissemination helped the organization respond to changing reimbursement policies, while in another case, the researcher concluded that a changing policy environment may have driven the adoption of the innovation. Another researcher created incentives by offering continuing medical education units to encourage physician use of a dissemination web site. Finally, a researcher commented that partner organizations often face strong policy or

organizational obstacles to adopting an innovation; their dedication and perseverance is sometimes overlooked by both researchers and funders.

Tenacity. Dissemination efforts can take longer than anticipated and require adaptations. Therefore, patience and flexibility are extremely important. Many researchers observed that proposals must plan for extra time and flexibility to be successful. Planning for dissemination and implementation even from the conceptualization phase was recommended by a majority of investigators, given the time and resources necessary to accommodate real-world settings and create a user-centered approach. However, one investigator cautioned that even under the most ideal conditions, where dissemination was always the ultimate goal and part of the guiding plan, the process required multiple revisions and accommodations. Another investigator noted that the requirements of the supplement grant applications made this type of planning difficult. The requirement to provide preliminary evidence justifying dissemination makes sense in theory, but in practice, it is difficult to plan for dissemination from the beginning if preliminary evidence has not yet been obtained, or if the efficacy of the intervention is uncertain.

Discussion and Recommendations

This analysis has yielded a set of recommendations to NCI. These recommendations are discussed below and summarized in Box 2. Most investigators felt their efforts were limited by the time and financial parameters of the supplement program. NCI's participation in the trans-NIH DIRH PAR provides an opportunity for D&I research that is larger in scope, as it funds R01, R03 and R21 mechanisms which last between two and five years. However, since most supplement grantees were unaware of these funding opportunities, NCI should reconsider its communications activities to make sure it is adequately targeting investigators with whom it has had previous relationships.

Several investigators expressed some frustration with the grant review process. Because dissemination and implementation researchers are focused on the application of previous knowledge, they are sometimes critiqued for being insufficiently innovative. These investigators argue that review committees may not value dissemination and implementation research, or see the value of other relevant methods and frameworks like cost-effectiveness research and organizational theories. At the same time, one investigator attributes the success of his dissemination project precisely to the use of cost data, as it provided the economic justification to decision-makers for the system-wide adoption of the innovative intervention. Given that some

researchers were conducting their work in organizations facing fiscal strains and working with under resourced communities, this data becomes even more important. Other investigators have successfully disseminated or implemented innovations, or published results in academic journals, by framing their work as quality improvement studies. For many investigators, their challenges revolved around the need to work with multiple systems, organizations, and personnel each with differing priorities; in essence, the organizational context, including barriers and facilitators, was one of the most important factors in carrying out the dissemination and implementation work. The more recent Trans-NIH DIRH PARs explicitly solicit proposals that advance cost and economic research, quality improvement studies, consideration of the organizational environment and linkages with a variety of other disciplines. Supporting, maintaining and developing these linkages, as well as building the knowledge among members of the DIRH Study Section, will be crucial to advancing the field of dissemination and implementation.

In four cases, investigators used various communications channels and strategies to strategically disseminate information about a proven intervention, and then assessed its uptake among the target audience. In two cases, even though the results were on par with the outcomes of similarly designed mass-marketing campaigns, the researchers were disappointed with the results, finding that uptake and implementation of the innovation was not as widespread as anticipated. Those investigators that achieved implementation, on the other hand, often did so by providing technical assistance to partner organizations, actively working with them to implement the intervention. In most cases, the research team worked closely with partner organizations to adapt, refine, and put the intervention into practice. This was often an intensive process requiring time, effort, planning, and patience. Although a widely-used method for implementation, most investigators did not acknowledge any particular framework for providing technical assistance. Further research could identify the methods (online versus. in-person) and intensity (daily, weekly, monthly) necessary to provide technical assistance. Secondly, given the time and labor necessary to provide assistance, there must be consideration of which methods are most cost-effective in the real world. NCI could also support a more active sharing of experiences between investigators seeking to adapt and implement interventions, perhaps via the new Research to Reality website (https://researchtoreality.cancer.gov/).

While many investigators could not present results in the traditional frame of a randomized controlled trial, they were, as documented above, able to achieve a number of other

successes. Though randomized controlled trials continue to be the gold standard of scientific and public health inquiry, dissemination and implementation researchers are concerned with more than intervention efficacy. Additionally, impact of D&I research should be evaluated by more than bibliometric tools, as the beneficial impact of dissemination and implementation activities extend well beyond the academic literature, achieving practical effects in the real world. RE-AIM is one often-used framework to evaluate the public health impact of an initiative, and was utilized by three supplement grantees. NCI and other funders should consider additional tools and methods to analyze research portfolios and assess the impact of their work. For example, the National Institute of Environmental Health Sciences has recently created a draft Evaluation Metrics Manual to assess some of its extramural research programs. By using a logic model approach, it focuses not only on the outputs of programs, but on their public health impacts. The manual provides approaches for analyzing the strength of community partnerships, community participation in the research process, contextual factors contributing to the implementation of a project, and the success, reach and impact of efforts to disseminate research findings. Investigators have identified these elements as critical impacts of their work, but a systematic way to measure them is lacking. New ways to evaluate the NIH's D&I research portfolio, coupled with the recent D&I Measures and Methods Initiative to compile and assess D&I constructs, outcomes and methodologies[iv], will continue to advance the field and establish its import in biomedical research.

Box 2. Recommendations to NCI

1. Promote the Trans-NIH Dissemination and Implementation Research in Health funding opportunity to supplement grantees

2. Continue to promote the multi-disciplinary nature of D&I research by encouraging linkages with the methods and frameworks of other relevant fields

3. Investigate methods to facilitate technical assistance and other means to disseminate interventions more actively and widely

4. Continue to define and develop the various outcomes of D&I research and a D&I research program, as well as the methods to measure and evaluate them

[iv] http://cancercontrol.cancer.gov/IS/dimmi.html

This analysis faced several limitations. First, in some cases, nearly a decade had passed since the supplements were first awarded. For those investigators who participated in the informal discussions, it may have been difficult for them to recall specific details. This was particularly notable when asking investigators to comment on their experiences using D&I frameworks. Second, the analysis was conducted by an employee of the National Cancer Institute. Investigators may have been hesitant to speak frankly, particularly about their challenges, with a representative of a funding organization. Finally, in the document review, there was great variation in the amount of detail available for each project. Some investigators compiled extensive reports and published articles, while for others there was very little with which to assess their work.

Conclusion

NCI's sponsorship of 20 cancer-control Dissemination and Diffusion supplements paved the way for its participation in a more robust research initiative, the Trans-NIH Dissemination and Implementation Research in Health PAR. Lessons learned from the supplement program can contribute to the advancement of D&I, a nascent, evolving field. The supplement program was analyzed using document review, an examination of NCI administrative data, and follow-up discussions with investigators. This analysis described the types of D&I research performed, the conceptual frameworks utilized and investigators' involvement with other D&I initiatives. Additionally, it has elucidated the successes achieved by the portfolio. Though many D&I studies did not provide crisp statistically significant intervention effects, researchers were able to articulate a number of impacts, including support of legislative change, more accountable healthcare organizations, and strong community partnerships. These findings have implications for the way NCI might continue to support D&I research, by improving communication with researchers, establishing linkages with related fields, encouraging the study of methods to provide technical assistance, and developing new approaches to evaluation.

References

1. Woolf SH. The meaning of translational research and why it matters. *JAMA*. Jan 9 2008;299(2):211-213.

2. Lomas J. Diffusion, dissemination, and implementation; who should do what? *Ann N Y Acad Sci*. 1993;703:226-35; discussion 235-7

3. Rogers E. Diffusion of innovations. *New York: Free Press*. 2003;5th ed.

4. Kerner J. Translating Research into Policy and Practice: Who's Influencing Whom? Presentation at the Annual National Health Policy Conference. Washington, DC. February 2007.

5. Lomas J. Improving Research and Uptake in the Health Sector: Beyond the Sound of One Hand Clapping. Centre for Health Economics and Policy Analysis. *Policy Commentary*. 1997; C97-1.

6. Rubenstein LV, Pugh J. Strategies for promoting organizational and practice change by advancing implementation research *J Gen Intern Med*. 2006;21 Suppl 2:S58-64. doi: 10.1111/j.1525-1497.2006.00364.x.

7. Glasgow RE, Vogt TM, Boles SM. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *Am J Public Health*. Sep 1999;89(9):1322-1327.

8. Green LW, Kreuter MW. Health program planning: An educational and ecological approach. *Mayfield Publishing Company*. 2005(4th ed).

9. Moulding NT, Silagy CA, Weller DP. A framework for effective management of change in clinical practice: Dissemination and implementation of clinical practice guidelines *Qual Health Care*. 1999;8(3):177-183.

10. Dobbins M, Ciliska D, Cockerill R, Barnsley J, DiCenso A. A framework for the dissemination and utilization of research for health-care policy and practice *Online J Knowl Synth Nurs*. 2002;9:7.

11. Green LW, Mercer SL. Can public health researchers and agencies reconcile the push from funding bodies and the pull from communities? *Am J Public Health*. 2001;91(12):1926-1929.

12. Tunis SR, Stryer DB, Clancy CM. Practical clinical trials: Increasing the value of clinical research for decision making in clinical and health policy *JAMA*. 2003;290(12):1624-1632. doi: 10.1001/jama.290.12.1624.

13. Orleans CT, Gruman J, Anderson N (1999) Roadmap for the Next Frontier: Getting Evidence-based Behavioral Medicine into Practice. Presented at Society of Behavioral Medicine Annual Meeting, San Diego CA, March 4, 1999.

14. Christoffel KK. Public health advocacy: Process and product *Am J Public Health*. 2000;90(5):722-726.

15. Downs A. Up and Down with Ecology-the Issue-Attention Cycle**.** Public Interest. 1972; 28 (Summer): 38-50.

16. Glasgow RE, Lichtenstein E, Marcus AC. Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to-effectiveness transition *Am J Public Health*. 2003;93(8):1261-1267.

17. Carney PA, Dietrich AJ, Keller A, Landgraf J, O'Connor GT. Tools, teamwork, and tenacity: An office system for cancer prevention *J Fam Pract*. 1992;35(4):388-394.

Bibliography of Dissemination and Implementation Publications Supported by NCI's Dissemination and Diffusion Supplement Program

Allicock M, Ko L, van der Sterren E, Valle CG, Campbell MK, Carr C. Pilot weight control intervention among US veterans to promote diets high in fruits and vegetables *Prev Med*. 2010;51(3-4):279-281. doi: 10.1016/j.ypmed.2010.06.010.

Buller DB, Buller MK, Kane I. Web-based strategies to disseminate a sun safety curriculum to public elementary schools and state-licensed child-care facilities *Health Psychol*. 2005;24(5):470-476. doi: 10.1037/0278-6133.24.5.470.

Buller DB, Buller MK, Reynolds KD. A survey of sun protection policy and education in secondary schools *J Am Acad Dermatol*. 2006;54(3):427-432. doi: 10.1016/j.jaad.2005.11.1030.

Buller DB, Young WF, Fisher KH, Maloy JA. The effect of endorsement by local opinion leaders and testimonials from teachers on the dissemination of a web-based smoking prevention program *Health Educ Res*. 2007;22(5):609-618. doi: 10.1093/her/cyl130.

Carney PA, Kettler M, Cook AJ, et al. An assessment of the likelihood, frequency, and content of verbal communication between radiologists and women receiving screening and diagnostic mammography *Acad Radiol*. 2009;16(9):1056-1063. doi: 10.1016/j.acra.2009.02.023.

de Moor JS, Puleo E, Butterfield RM, Li FP, Emmons KM. Availability of smoking prevention and cessation services for childhood cancer survivors *Cancer Causes Control*. 2007;18(4):423-430. doi: 10.1007/s10552-006-0110-y.

Dick JF,3rd, Gallagher TH, Brenner RJ, et al. Predictors of radiologists' perceived risk of malpractice lawsuits in breast imaging *AJR Am J Roentgenol*. 2009;192(2):327-333. doi: 10.2214/AJR.07.3346.

Dietrich AJ, Tobin JN, Cassells A, et al. Translation of an efficacious cancer-screening intervention to women enrolled in a medicaid managed care organization *Ann Fam Med*. 2007;5(4):320-327. doi: 10.1370/afm.701.

Gallagher TH, Cook AJ, Brenner RJ, et al. Disclosing harmful mammography errors to patients *Radiology*. 2009;253(2):443-452. doi: 10.1148/radiol.2532082320.

Levy DT, Tworek C, Hahn EJ, Davis RE. The kentucky SimSmoke tobacco policy simulation model: Reaching healthy people 2010 goals through policy change *South Med J*. 2008;101(5):503-507. doi: 10.1097/SMJ.0b013e31816c013c.

Marcus AC, Heimendinger J, Berman E, et al. A case study in dissemination: Lessons learned from a pilot study involving the national cancer institute's cancer information service *J Health Commun*. 2005;10 Suppl 1:219-233. doi: 10.1080/10810730500257689.

Nanney MS, Haire-Joshu D, Brownson RC, Kostelc J, Stephen M, Elliott M. Awareness and adoption of a nationally disseminated dietary curriculum *Am J Health Behav*. 2007;31(1):64-73. doi: 10.5555/ajhb.2007.31.1.64.

Robinson AC, Maceachren AM, Roth RE. Designing a web-based learning portal for geographic visualization and analysis in public health *Health Informatics J*. 2011;17(3):191-208. doi: 10.1177/1460458211409718.

Shiovitz S, Gay A, Morris A, Graff JJ, Katz SJ, Hawley ST. Dissemination of quality-of-care research findings to breast oncology surgeons *J Oncol Pract*. 2011;7(4):257-262. doi: 10.1200/JOP.2010.000195.

Whiteley JA, Napolitano MA, Lewis BA, et al. Commit to quit in the YMCAs: Translating an evidence-based quit smoking program for women into a community setting *Nicotine Tob Res*. 2007;9(11):1227-1235. doi: 10.1080/14622200701648334.

Appendix 1. Funded Dissemination and Diffusion Supplements[v]

PI Name Organization Name	Project Title (click for Abstract)
Buller, David B. COOPER INSTITUTE	SUNNY DAYS HEALTHY WAYS GRADES 6-8 SUN SAFETY CURRICULUM
Buller, David B. COOPER INSTITUTE	WEB BASED SUPPORT--COMMUNITY TOBACCO CONTROL COALITIONS
Campbell, Marci K. UNIVERSITY OF NORTH CAROLINA CHAPEL HILL	HEALTH COMMUNICATION IN CANCER CONTROL
Dietrich, Allen J. DARTMOUTH COLLEGE	NY PREVENTION CARE MANAGER PROJECT
Elmore, Joann G. UNIVERSITY OF WASHINGTON	UNDERSTANDING VARIABILITY IN COMMUNITY MAMMOGRAPHY
Emmons, Karen M. DANA-FARBER CANCER INSTITUTE	SMOKING CESSATION AMONG CHILDHOOD CANCER SURVIVORS
Geller, Berta M. UNIVERSITY OF VERMONT & ST AGRIC COLLEGE	VERMONT BREAST CANCER SURVEILLANCE SYSTEM
Haire-Joshu, Debra SAINT LOUIS UNIVERSITY	ALTERING DIETARY PATTERNS IN PRESCHOOL CHILDREN
Katz, Steven J. UNIVERSITY OF MICHIGAN AT ANN ARBOR	HEALTH SYSTEM FACTORS AND PATIENT OUTCOMES IN BREAST CANCER
Levy, David T. PACIFIC INSTITUTE FOR RES AND EVALUATION	A SIMULATION OF TOBACCO POLICY, SMOKING AND LUNG CANCER
MacEachren, Alan M. PENNSYLVANIA STATE UNIVERSITY-UNIV PARK	GEOVISUALIZATION AND SPATIAL ANALYSIS OF CANCER DATA
Mandelblatt, Jeanne S. GEORGETOWN UNIVERSITY	CISNET: THE "SPECTRUM" OF BREAST CANCER DISPARITIES
Marcus, Alfred C. AMC CANCER RESEARCH CENTER	5-A-DAY FOR BETTER HEALTH DISSEMINATION
Marcus, Bess H. MIRIAM HOSPITAL	EXERCISE TO AID SMOKING CESSATION IN WOMEN
Mayer, Joni A. SAN DIEGO STATE UNIVERSITY	MULTI-LEVEL ASSESSMENT OF INDOOR TANNING PRACTICES
Ossip-Klein, Deborah J. UNIVERSITY OF ROCHESTER	PRIMARY CARE AND SELF HELP INTERVENTION FOR TEEN SMOKERS
Pasick, Rena J. CANCER PREVENTION INSTITUTE OF CALIFORNIA	CANCER SCREENING, MANAGED CARE, AND THE UNDERSERVED
Swan, Gary E. SRI INTERNATIONAL	TREATMENT OF NICOTINE DEPENDENCE IN AN HMO SETTING
Vernon, Sally W. UNIVERSITY OF TEXAS HLTH SCI CTR HOUSTON	WOMEN VETERANS AND BREAST CANCER SCREENING

[v] Available at http://cancercontrol.cancer.gov/is/custom_portfolio.asp?portfolio=dandd

Appendix 2. Follow-Up Questions with Investigators

Section 1. Questions about findings and lessons learned: Grant Specific

1. Are there any other publications or presentations that we should be aware of?

2. How did you adapt the parent trial intervention or surveillance system for dissemination/implementation? Were the results or outcomes different or unexpected?

3. What would you describe as the key findings/accomplishments of your work?

4. What are some of the key lessons learned during your experience disseminating/implementing these research products? What did you learn about the process of research dissemination/implementation?

5. Would you characterize the dissemination/implementation as a success?

6. Did your work result in any policy changes, relatively enduring changes, etc.?

Section 2. Questions about working with stakeholders

1. What did you learn about the setting(s) or institution in which you were disseminating? (If targeting more than one setting or organization) Were you able to use the same dissemination/implementation approach with all settings/ organizations or did you need to modify your approach for different settings? Explain

2. To what extent did you partner with other organizations or stakeholders - for example to act as honest brokers or help you get access? Did you face any challenges in developing or executing these partnerships?

Section 3. Questions about findings and lessons learned: General

1. What advice would you give to other researchers about performing dissemination/implementation research?

2. What major challenges did you face in disseminating/implementing the intervention or surveillance product?

3. What major successes did you face in disseminating/implementing the intervention or surveillance product?

4. Did your dissemination work answer any questions/resolve any issues/provide a path forward for D&I Science?

Section 4. Additional Questions about Working with NCI or other Funders

1. Was your intervention appropriate for submission to the Research-Tested Intervention Programs website? Did you submit it? If not, why not?

2. Have you received/will you receive financial support outside of NCI/NIH to do dissemination and implementation?

3. Are you familiar with the trans-NIH PAR on dissemination and implementation research in health?

4. Have you participated in the annual NIH D&I Conference in the past? In what capacity? Would you be willing to present your work at future conferences?

5. Is there anything I missed that would be relevant for our summary evaluation? Any last thoughts?