An Introduction to Implementation Science for Environmental Health

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What is Implementation Science?

Implementation science (IS) is the study of methods to promote the adoption and integration of evidence-based practices, interventions, and policies into routine health care and public health settings to improve our impact on population health

https://cancercontrol.cancer.gov/is/about
Origins of Implementation Science – “the gap”

- Recognition of:
  - Research to practice gap in health care: moving scientific evidence into real-world settings has taken a lot of time (Balas & Boren 2000, Grant et al. 2003, Morris et al. 2011).
  - Effectiveness does not always equal public health impact (Bauer & Kirchner 2020)
  - Implementation science is focused on the “HOW” question: how can we move interventions, practices, and policies into real-world settings like health care systems, schools...and communities impacted by environmental exposures?
A simple way to think about implementation science...

- “The intervention/practice/innovation is THE THING
- Effectiveness research looks at whether THE THING works
- Implementation research looks at how best to help people/places DO THE THING
- Implementation strategies are the stuff we do to try to help people/places DO THE THING
- Main implementation outcomes are HOW MUCH and HOW WELL they DO THE THING”

A hypothetical example:

You are working with a fenceline community impacted by high levels of air pollution coming from a petrochemical plant (PM, VOCs) – there are extremely high rates of childhood asthma.
The “Thing”:

An educational toolkit to help parents teach their children about what is in the air, how it affects their health and steps to mitigate exposure (e.g., not playing outside during peak exposure hours)
Effectiveness (testing “the thing”):

Parents felt their children’s awareness about air pollution and its link to asthma increased – parents report that their children are more likely to stay inside during peak exposure hours – health care data shows that asthma exacerbation rates have declined for children in this community – “the thing” works!
Implementation:

You then use the “the thing” in another fenceline community, but parents do not feel that their children understand the link between air pollution and asthma - children are not staying inside during peak exposure hours - asthma exacerbation rates have not declined. There is some barrier (or barriers) that prevent parents in this community from using “the thing”
Implementation Strategies:

Implementation science can help you identify these barriers and identify/test strategies that can help the parents in this community use “the thing” – you build a community advisory board and hold educational meetings (i.e., identify strategies) to help parents in this community use “the thing”
Implementation Strategies
(Powell et al. 2015, Waltz et al. 2015)

- What barriers are you trying to overcome?
- What resources are you able to leverage?
- Who are your stakeholders?

Slide courtesy of Gila Neta, NCI
Implementation (vs. Effectiveness) Outcomes (Proctor et al. 2011)

- Uptake
- Sustainability
- Feasibility
- Acceptability
- Fidelity
- Appropriateness
- Penetration
- Costs
Hybrid Designs: Enhancing Translation Potential

• Hybrid 1:
  • Effectiveness
    • Implementation

• Hybrid 2:
  • Effectiveness - Implementation

• Hybrid 3:
  • Implementation
    • Effectiveness

Curran et al. (2012). Effectiveness-implementation hybrid designs: combining elements of clinical effectiveness and implementation research to enhance public health impact Med Care.
Context Matters!

- Socioecologic Framework (see Tabak et al. 2013):
  - Individual;
  - Community;
  - Organization; &
  - System-levels

https://www.nimhd.nih.gov/about/overview/research-framework/nimhd-framework.html
Theories, Models and Frameworks
(Nilsen 2015)

- **Process Models**
  - Guide the implementation process

- **Determinant Frameworks**
  - Implementation outcomes are impacted by barriers and facilitators

- **Evaluation Frameworks**
  - Help researchers frame implementation success
Why does Implementation Science Matter for Environmental Health?

A Case Study
**Clean Cooking Implementation Science Network (ISN)**

- **Public Health Issue:**
  - Millions of deaths from household air pollution (HAP) – biomass stoves - open fire use in low- and middle-income countries
  - Women, children, poor disproportionately affected
  - Need for uptake and sustained use of clean cooking methods (e.g., liquid petroleum gas [LPG])
  - Multi-level barriers to implementation of clean cooking: fuel characteristics, household characteristics, knowledge/perceptions, affordability, supply chain, regulations and policies to support clean cooking
  - Implementation of multi-sectoral and multi-level interventions are needed

Rosenthal et al. 2017
Clean Cooking Implementation
Science Network (ISN)

- **Implementation Science Questions:**
  - **How** can clean cooking (i.e., the intervention or ‘the thing’) be implemented?
  - Household and community level **adoption**: what adoption level is needed to impact health outcomes?
  - **Stakeholder perspectives:** what do households need for cooking? What can these perspectives tell us that will help implementation?
  - What **implementation strategies** are needed to support the uptake of clean cooking interventions?
Affordability, Accessibility, and Awareness (3As) (Kumar et al. 2020)

What determinants impact the adoption of LPG in rural India?

- **Affordability**: income is one determinant as higher income increases LPG adoption.
- **Accessibility**: Biomass (e.g., wood) availability is a barrier to LPG adoption – rural women collect the biomass and prioritize it over alternatives.
- **Awareness**: adoption is impacted by concerns about LPG safety/explosions – awareness campaigns are a key strategy to support LPG adoption in poor households.
Photovoice and LPG Adoption
(Ronzi et al. 2019)

What are the community perceptions of LPG adoption in South-West Cameroon?

- **Barriers**: affordability of equipment/refills, transportation costs for refills/distance, safety (e.g., plank houses), lack of LPG shops
- **Facilitators**: greater awareness – LPG health benefits, more shops in rural areas, increasing safety, lowering cost of refills
- Photo exhibition as advocacy – involved government ministries and other stakeholders (LPG marketers, media, community members/leaders)
- Community perceptions highlight **multi-level barriers to uptake** – individual-level factors (e.g., awareness) and regional/national-level factors (e.g., costs)
For more on the Clean Cookstove ISN:

- [https://www.fic.nih.gov/About/Staff/Policy-Planning-Evaluation/Pages/clean-cooking-implementation-science-network.aspx](https://www.fic.nih.gov/About/Staff/Policy-Planning-Evaluation/Pages/clean-cooking-implementation-science-network.aspx)
“Equity is ‘the state, quality, or ideal of being just, impartial, and fair.’ The concept of equity is synonymous with fairness and justice. To be achieved and sustained, equity needs to be thought of as a structural and systemic concept.” [emphasis added]

Advancing Environmental Health Equity at NIEHS

Image Credit: Liam O’Fallon & Melissa Smarr (NIEHS)

The focus of EJ action is on the causes of EHD

Implementation Science

Environmental Health Disparities Research
Highlights underlying inequities related to environmental exposures and health outcomes

Environmental Justice Action
Identifies strategies and the means for addressing these inequities including regulatory enforcement or policy change
10 Recommendations to Advance Equitable Implementation

**Build Trusting Relationships**
1. Take the time to build trust through small, frequent interactions

**Dismantle Power Structures**
2. Shed the solo leader model of implementation
3. Distribute information and decision-making authority to those whose lives are most affected by the implementation

**Invest and Make Decisions to Advance Equity**
4. Engage in deliberate and transparent decision-making
5. Engage community members in interpreting and using data to support implementation

10 Recommendations to Advance Equitable Implementation Continued

Develop Community-Defined Evidence
6. Co-design interventions with community members

Make Adaptations [including cultural adaptations]
7. Seek locally based service delivery platforms
8. Address issues of social justice [systemic & structural racism]

Critical Perspectives on Implementation Science
9. Develop implementation strategies that address the contextual factors that contribute to disparities in outcomes
10. Seek long-term outcomes that advance equity

Structural Racism & Implementation Science – Recommendations

1. Inclusion of structural racism in implementation science theories, models, frameworks and measures
2. Multi-level approaches: select, develop and implement interventions and implementation strategies to address structural racism
3. Transdisciplinary and intersectoral collaborations and engagement as essential implementation science methods

10 Key Ingredients
Proctor et al. 2012

Adapted for Environmental Health
#1 – The Gap

- What is the environmental public health gap that you are addressing in the proposal?
- How will the implementation of this intervention, innovation, practice (i.e., ‘the thing’) reduce this gap?

**Review criteria:** Significance, Impact
#2 – The Evidence-Based Intervention, Innovation or Policy

- Have you provided evidence that the intervention, innovation, practice (i.e., ‘the thing’) works?
- Establishing ‘readiness’ of ‘the thing’ – prior effectiveness research – literature review to establish the evidence base
- **Review criteria:** Significance, Innovation
#3 – Conceptual Model & Theory

- What implementation science theories, models and frameworks are you using?
- Clearly show how these are linked to your research design and variables
- **Review criteria:** Approach, Innovation
#4 – Stakeholder Priorities - Engagement in Change

- Who are your stakeholders?
- How have you demonstrated their engagement in this study? (think beyond letters of support)
- Is your stakeholder engagement equitable? Have you considered power imbalances?
- **Review criteria**: Significance, Impact, Approach, Environment
#5 – Readiness to adopt the intervention, innovation, policy

- Is the setting, community, etc., ready for the intervention, innovation, practice (i.e., ‘the thing’)?
- What evidence have you provided that the setting will adopt ‘the thing’?
- **Review criteria:** Impact, Approach, Environment
#6 – Implementation Strategy/Process

- What implementation strategies have you proposed?
- Have you described the rationale for these strategies?
- Are your strategies multifaceted, multilevel, multisectoral?
- Have you provided evidence that you have used these strategies?
- **Review criteria:** Significance, Impact, Innovation
#7 – Team Experience: Setting, Intervention, Implementation

- Do you have experience in this setting, community, etc.?
- Have you described that experience?
- Have you described your experience with the intervention, innovation, practice (i.e., ‘the thing’)?
- What is your experience with the implementation process?
- **Review criteria**: Approach, Investigator team
#8 – Feasibility of Proposed Research Design/Methods

- Have you included enough detail on your methods (think both quantitative and qualitative methods)?
- Contingency plans if you must pivot from these methods – randomization may not always be possible.
- **Review criteria:** Approach, Investigator team
#9 – Measurement & Analysis Section

- What are your measures? Are they linked to your model, framework, theory?
- How will you measure the constructs proposed? (i.e., high quality measures, data harmonization)
- How do these constructs relate to one another? (i.e., analysis)
- **Review criteria:** Approach, Investigator team
#10 – Policy Environment, Sustained Change

- Have you described the “policy context” behind this work?
- Policy relevance = public health impact, feasibility
- Describing the policy context = awareness of policy-level challenges to implementation
- **Review criteria:** Impact, Significance
Resources
Training Institute for Dissemination and Implementation Research in Cancer (TIDIRC)

The Training Institute for Dissemination and Implementation Research in Cancer (TIDIRC) provides participants with a thorough grounding in conducting D&I research with a specific focus on cancer. All online training materials are open access. Applications for the facilitated program are accepted annually. Learn more.

14th Annual Conference on the Science of Dissemination and Implementation in Health

Bridging the gap between research, practice, and policy.

Implementation Science in Environmental Health

Theme two of the NIEHS Strategic plan (Promoting Translation – Data to Knowledge to Action) supports research to develop, test, and validate evidence-based prevention and intervention strategies, to reduce or avoid exposures and their resulting health impacts. The NIEHS supports the use of implementation science to improve environmental public health through the adaptation, uptake, sustainment and spread of evidence-based interventions, practices, and policies that prevent or mitigate harmful exposures and support environmental health equity.

Dissemination & Implementation Orientation Webinar

This webinar is an introduction and orientation to the science of dissemination and implementation (D&I) for those who are new to this field.

View Webinar

Implementation Science Webinars

Listen as leaders in the field discuss advanced dissemination and implementation research topics and answer questions from the community.

Research to Reality (R2R) Cyber Seminars

Research to Reality (R2R) Cyber Seminars bring together cancer control practitioners and researchers to discuss moving evidence-based programs into practice.
NIH Wide Funding Opportunities

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**R01, Dissemination and Implementation Research in Health (PAR-19-274, Clinical Trial Optional)**

This funding opportunity provides research project grants to support discrete, specified research projects led by an investigator in a topic area representing his or her specific interests and competencies. Because the nature and scope of the proposed research will vary from application to application, it is anticipated that the size and duration of each award will also vary. Applications may not exceed 5 years.

**R21, Dissemination and Implementation Research in Health (PAR-19-275, Clinical Trial Optional)**

This funding opportunity provides grants that are intended to encourage exploratory or developmental research projects by supporting the development of pilot projects or feasibility studies to support creative, novel, and high-risk/high-payoff research. Applicants may request a project period of up to 2 years and the combined budget for direct costs may not exceed $275,000.

**R03, Dissemination and Implementation Research in Health (PAR-19-276, Clinical Trial Not Allowed)**

This funding opportunity provides small research grants to support the initiation of studies that are generally for preliminary short-term projects. Applicants for an R03 award may request a project period of up to 2 years and a budget for direct costs of up to $50,000 per year. While the grant is nonrenewable, there is less competition for these start-up research project funds.
D&I Funding Opportunity Announcements:

• **Dissemination research** is defined as the scientific study of **targeted distribution of information and intervention materials** to a specific public health or clinical practice audience. The intent is to understand how best to communicate and integrate knowledge and the associated evidence-based interventions.

• **Implementation research** is defined as the scientific study of the **use of strategies** to adopt and integrate evidence-based health interventions into clinical and community settings to improve individual outcomes and benefit population health.

PAR-19-274: Dissemination and Implementation Research in Health (R01 Clinical Trial Optional)
Select D&I Topic Areas:

- Studies of the local adaptation of evidence-based practices in the context of implementation
- Longitudinal and follow-up studies on the factors that contribute to the sustainability of evidence-based intervention in public health [settings]
- Studies testing the effectiveness and cost-effectiveness of dissemination or implementation strategies to reduce health disparities...among rural, minority...and other underserved populations
- Studies on reducing or stopping ("de-implementing") the use of...community practices that are ineffective, unproven, low-value, or harmful
- Studies of policies and other contextual factors that influence the success of dissemination or implementation efforts
- Studies of the relationship of context and local capacity of...community settings to adoption, implementation, and sustainability of evidence-based practices
- Studies that focus on the testing of theories, models, and frameworks for D&I processes