HHS Public Access

Author manuscript

Clin Transl Sci. Author manuscript; available in PMC 2016 December 01.

Published in final edited form as:

Clin Transl Sci. 2015 December ; 8(6): 807–813. doi:10.1111/cts.12313.

Dissemination, implementation and improvement science research in population health: Opportunities for public health and CTSAs

Tony Kuo, MD, MSHS[a,b,c,*], **Lauren N. Gase, MPH**[a,d], **Moira Inkelas, PhD, MPH**[d], and **The Population Health and Policy Workgroup**

[a] Division of Chronic Disease and Injury Prevention, Los Angeles County Department of Public Health, Los Angeles, California

[b] Department of Epidemiology, UCLA Fielding School of Public Health, Los Angeles, California

[c] Department of Family Medicine, David Geffen School of Medicine at UCLA, Los Angeles, California

[d] Department of Health Policy and Management, UCLA Fielding School of Public Health, Los Angeles, California

Abstract

Importance—The complex, dynamic nature of health systems requires dissemination, implementation and improvement (DII) sciences to effectively translate emerging knowledge into practice. Although they hold great promise for informing multi-sector policies and system-level changes, these methods are often not strategically used by public health.

Objectives and Methods—More than 120 stakeholders from Southern California, including the community, federal and local government, university, and health services were convened to identify key priorities and opportunities for public health departments and Clinical and Translational Science Awards programs (CTSAs) to advance DII sciences in population health.

Main Outcomes—Participants identified challenges (mismatch of practice realities with narrowly-focused research questions; lack of iterative learning) and solutions (using methods that fit the dynamic nature of the real world; aligning theories of change across sectors) for applying DII science research to public health problems. Pragmatic steps that public health and CTSAs can

[*]Corresponding Author Tony Kuo, MD, MSHS, Deputy Director, Division of Chronic Disease and Injury Prevention, Los Angeles County Department of Public Health, 3530 Wilshire Blvd, 8th Floor, Los Angeles, CA 90010, Tel: (213) 351-7341; Fax: (213) 351-2713.

The Population Health and Policy Workgroup
Jeffrey D. Gunzenhauser, MD, MPH
Henry Anaya, PhD
Fatinah Darwish, RD

Conflict of Interests

The manuscript authors declare that they have no conflict of interests, financial or other, to declare.

Previous Presentations

The work is based on preliminary findings, stakeholder engagement efforts, and forum discussions presented at the 2014 Southern California Regional Dissemination, Implementation and Improvement Science Symposium sponsored, in part, by the National Institutes of Health/National Center for Advancing Translational Sciences through UCLA CTSI Grant Number UL1TR000124, the Southern California CTSI Grant Number UL1TR000130, and Kaiser Permanente Southern California.

take to facilitate DII science research include: employing appropriate study designs; training scientists and practicing professionals in these methods; securing resources to advance this work; and supporting team science to solve complex-systems issues.

Conclusions—Public health and CTSAs represent a unique model of practice for advancing DII research in population health. The partnership can inform policy and program development in local communities.

Keywords

population health; public health strategies; translational research; community engagement; dissemination; implementation; improvement sciences

Introduction

The gap between knowledge and practice is a major focus of health services research.[1,2] A number of efforts have collectively sought to advance translational research that targets the reasons for this gap.[1,3] Dissemination, implementation and improvement (DII) sciences are becoming a growing focus among health services researchers and those who are interested in addessing complex systems issues related to patient care[1,4] and population health.

Implementation science focuses on understanding organizational elements in the real world that influence adoption of desired protocols and practices. In recent years, scientists and health leaders alike have come to recognize the complexity of implementing interventions in real world practice contexts.[5,6] There have been a number of published models that describe contextual elements of these implementation processes.[6-8]

Improvement science refers to the “design, development, and evaluation of complex interventions to produce generalizable new knowledge related to creating and sustaining improvement in health care delivery in real world settings”.[9] A hallmark of improvement science research is iterative learning with planned testing under all relevant conditions of care delivery with a focus on scale-up and spread.[10] Finally, dissemination science studies the uptake and utilization of an intervention so as to implement at scale what has been found to work in pilot and by efficacy studies.[7,11,12] Although distinct in their focus, the framework and methods used in each of these sciences are not unrelated or mutually exclusive.

Closing the gap between research and practice is especially challenging when the goal is not to change a single isolated service or protocol, but to change a series or sequence of processes that involve multiple programs and actors. This is often what public health is trying to accomplish in improving the health of populations. Understanding what works in the conditions of real world practice is a critical need for many population-focused entities, including public health and health systems that are evolving to respond to changes mandated by the Patient Protection and Affordable Care Act of 2010 (ACA, 2010).[13] Many public health leaders recognize the potential value of DII sciences for informing policy, systems, and environmental (PSE) changes that can improve the health status of populations.[14,15-18] Yet DII sciences are underused or not strategically applied in public health practice.

The purpose of this article is to identify and conceptualize an integrated learning approach based on DII sciences that public health and Clinical Translational Science Awards programs (CTSAs) can apply in the real world to address population health issues. We introduce potential strategies for bridging the culture and traditions of public health with those of the DII science research community. We focus specifically on outlining pragmatic ways in which local public health departments and CTSAs can collaborate to advance the practice and application of these critical translational methods (Table 1).

Stakeholder Forum and Methods Used to Identify Gaps and Describe Pragmatic Solutions

The CTSA strategies described in this article were based on and guided by preliminary findings, stakeholder engagement efforts, and forum discussions presented at the 2014 Southern California Dissemination, Implementation and Improvement Science Symposium, sponsored by the University of California, Los Angeles (UCLA) Clinical Translational Science Institute (CTSI), University of Southern California (USC) CTSI, and Kaiser Permanente. The goal of the day-long symposium was to accelerate the quantity, quality and success of DII *Science* programs and activities in Southern California by (a) sharing knowledge and information regarding current DII science-related activities in the greater Los Angeles area; (b) fostering networking opportunities and collaboration between experienced researchers, academics new to the field, and community partners from local health care delivery systems and public health agencies interested in participating as an integral part of the Initiative's mission, goals, strategies and operational plans; and (c) introducing DII science methods that are either underused in population health or not optimally applied in public health practice.

A diverse group of 121 participants attended the symposium. Among them, 64% were from academia, 49% were from health care systems, and 11% worked in public health (albeit participants can list more than one setting).[19] Keynote speakers, representing funding agencies, public and private delivery systems, and medical associations, delivered addresses on the importance and opportunities for DII science research in health and public health sectors. Participants discussed the challenges to designing and conducting DII science research that meets the needs of stakeholders in health care, public health, and in the communities. Breakout sessions (10 to 30 participants each) were moderated by a UCLA or USC faculty member and a research-fellow who were selected based on their expertise and experience in the discussion topic. The goal of one of these sessions was to identify challenges and opportunities for public health and CTSAs to work together to advance DII science research in population health. Rather than achieving consensus, the group sessions sought to describe both the problem and potential pragmatic solutions that can be implemented to address the problem. More information on the background, mission and goals of the symposium can be found in the overview article.[19]

Challenges and Identified Solutions for Advancing DII Science Research in Population Health

Issue 1: Research questions traditionally posed by researchers are narrowly-focused and are often not a good fit with public health practice realities, creating mismatches.

The birds-eye perspective of public health positions these agencies to implement multiple interventions in a community and to assess their collective impact. However, a major challenge to optimizing this often-overlooked function of public health is the prevailing paradigm that science should focus on service delivery rather than PSE efforts, and/or evaluate interventions in isolation to assess their marginal value.[20,21] For example, comparative effectiveness research seeks to understand whether one type of treatment is more effective than another. While such a narrowly-focused approach may support informational needs about a specific care protocol in a medical setting, a research strategy which attempts to isolate the impact of a single-strategy or even single-sector intervention is rarely useful in public health practice. In public health, multiple concerted efforts (e.g., health education combined with environmental modification and policies) are needed to facilitate behavior change and promote health in the population.

Solution: DII sciences can be used to modify the research approach.

Public health can be a leader in showing how to apply DII models of research and evaluation to assess collective impact in population health.[22] CTSAs can support public health research and demonstrate how research on complex systems can be accomplished. This includes clarifying the research questions and identifying the most appropriate DII sciences and related methods to evaluate the implementation or translational processes associated with disease prevention and health promotion for a population in a complex system.[5,23,24] If aligned appropriately, public health systems and the communities they serve can function as *real world collaborative laboratories* in which CTSAs partner with public agencies, local organizations, and residents to learn together and address common population health problems in a more comprehensive and pragmatic way, measuring outcomes that can meaningfully inform practice.

As a case example, to assist local school districts to meet the latest nutrition standards of the United States Department of Agriculture's National Lunch and Breakfast Programs,[25] the Los Angeles County Department of Public Health (DPH) partnered with the UCLA Fielding School of Public Health during the 2011-12 school year to assist the Los Angeles Unified School District in re-structuring their meal programs, including menu changes and food environment modifications (i.e., redesign of the location and presentation of foods).[26-28] DPH and UCLA used a collaborative laboratory approach, providing evaluation support to assess program improvements; evaluation methods included nutritional analysis to verify desired changes in nutrient limits (e.g., sodium, calories, sugar, fat) in the school cafeterias and documentation of food waste via reviews of food production records and a series of plate waste studies at four randomly selected middle schools.[29,30] In an ongoing project, DPH is conducting a study to better understand the effects of accompanying *behavioral economics* strategies in promoting healthy eating – in the same school cafeterias where

menu changes had occurred. With timely alignment to program implementation, this evaluation implemented a case-comparison, waitlist design to assess the strategy's impact in more than 20 schools. The methods used by DPH and UCLA to conduct these program evaluations are now being utilized by the Centers for Disease Control and Prevention (CDC) and other communities to study the impact and spread of similar PSE changes implemented in local food venues across the United States (U.S.).

Issue 2: Processes associated with iterative learning and innovations are dynamic and may be difficult to study in the real world.

Another common challenge in public health is that complex systems are dynamic and comprise problems that are never permanently solved. Like large population-focused health systems, public health is challenged to create or guide systems that produce the desired outcome outside of the ideal and controlled conditions of traditional clinical and community trials. Public health is also tasked with answering questions about cost-benefits of health programs and their impacts over time, in many instances projecting into the future.[31,32] Individual programs focus on achieving specific desired results, whereas public health looks for ways to make meaningful improvements across the diverse, complex and interdependent myriad of services and support systems in the communities. One common problem in public health research is there is no true baseline. The temporal relationship between a new strategy and the intended outcome is confounded by prior and competing programs in the system, inconsistent start dates and stage duration during implementation, and logistical considerations including costs and administrative delays. In policy development, this challenge is further amplified by the dynamic flow of events including political forces that influence program content but are not easily predicted in advance. Public health agencies are often asked to respond rapidly to policy and system-level decision questions. These shorter timeframe questions require the use of methods that adapt and more easily integrate into real world processes.

Solution: Develop and utilize DII methods that fit the dynamic elements of the policy or real world environment.

Pragmatic trials allow for application of a rigorous design under real world conditions, helping to increase confidence in external validity.[33,34] Improvement science is particularly suited for public health questions that deal with dynamic processes because it embraces rather than seeks to control real world complexity. Improvement science offers an organized iterative learning process in which the actual interventions are adapted in real-time, using frequent measurements (in days, weeks or months) to provide rapid feedback with the goal of ongoing learning and adaptation. Time series and stepped wedge designs are especially useful in real world settings in which there is no single baseline measure.[35] Statistical process control uses repeated measures with the expectation that the underlying system is constantly changing. Even though time-series approaches are much more robust and appropriate than pre-post designs in many cases,[36] they are rarely employed in policy or practice research related to population health. Even when they are employed, time-series methods are often used to test the impact of a defined program (as in developmental

evaluation) rather than to support iterative innovation that can lead to effective and generalizable interventions.[37]

Quality improvement methods can be applied to speed learning and implement feedback loops and application of knowledge closer to real time. At the policy or practice level, there is a growing need for researchers to employ these mixed qualitative and quantitative approaches that iteratively capture data in the midstream – i.e., a data infrastructure or feedback loop that can continually inform program responses to what is being learned.[37-39] For example, the *Magnolia Community Initiative* (MCI) in Los Angeles strives to improve the health and educational outcomes of children living in an underserved area with a population of 100,000. With support from the UCLA CTSI, a number of community organizations and public services departments in the geographic corridor have begun using small scale testing and run charts to learn how best to introduce changes to their surrounding environments. These organization/agency-initiated changes have included such efforts as resilience-promoting strategies in neighborhoods; parent-child daily reading as a positive home routine; and processes within organizations that identify and link residents to community resources and supports that address social isolation, depression and concerns about child development. The MCI represents a prototype of a learning population system[38] modeled after the learning healthcare system,[39] applying design concepts and time series analysis of relevant measures to create a more health producing community in the targeted area of Los Angeles.

Other emerging analytic strategies in DII science research include the use of health impact assessments and complex systems science methods such as agent-based modeling and microsimulations.[24,32,40-42] Equipped with more knowledge and methodological expertise from CTSAs, public health leaders and staff are positioned and better suited than external researchers or research firms to integrate these approaches in the evaluation of implementation processes related to public health interventions (e.g., policies, system changes, population health programming).

Issue 3: Selection and application of a common theory of change to guide population and system-wide approaches is often lacking in public health planning.

DII sciences are invaluable for those interested in how to change outcomes for community populations because it focuses on the root causes of behaviors, practice adoption, and impact in real world settings. For systems that promote population health to have the greatest impact, mutually-reinforcing services and support systems from different sectors (e.g., health services, social services, legal/law enforcement, education) are needed and should be optimized to reduce duplications and siloed planning.[21] In this context, a shared or common theory of change is beneficial because it describes a causal pathway that can help multiple sectors and partners, including public health agencies, to identify and conceptualize elements they each influence and modify to solve complex health challenges.[20,22] A theory of change that identifies mutually reinforcing activities between these system partners can help bring scalable and pragmatic ideas and solutions to the forefront of decision-making. A major challenge is that these causes are frequently labeled differently by distinct research disciplines and acted on independently and with autonomy by multiple sectors. This problem

is compounded by researchers and public health practitioners alike focusing on one program or set of services at a time, despite knowledge that some population outcomes can only be achieved by changing policies and practices that can be taken to scale and sustained across a wide range of settings.[20] For public health agencies, the requirements of categorical funding or sponsors often constrain programs to be risk factor driven or disease-focused.[21,26] This constrained scope often leads to agencies implementing separate programs or campaigns when they could actually realize better results from the same resource investment if there was greater sharing of information and recognition of the underlying theory or theories of change that addresses common determinants.[43,44] For example, individual resilience is embraced as a critical input in disaster preparedness funding, but interventions to promote it are not always well aligned with other health and public health interventions even though the same construct defined as coping (ability to buffer stressors) drives important individual-level behaviors including self-management of chronic conditions and the ability to adopt positive health-promoting behaviors.[45] In Los Angeles County, this disconnect is no more evident than in the local public health department's use of resilience indicators in emergency preparedness activities but rarely in chronic disease prevention and control.[46,47]

Solution: DII sciences can help promote synergies in policies and public health practice by aligning theories of change to create common indicators across conditions and sectors.

Researchers and public health practitioners embracing a common theory of change that identifies shared elements across frameworks can help to promote synergies in policies and practice. Public health agencies at the local level, if not regionally and nationally, could benefit from funding strategies that apply knowledge of health determinants in a more consistent, systematic way across multiple sectors to affect change.[48] A natural starting point is with collaborative public health-university research partnerships where the public health agencies identify and participate in DII science research, taking a complex systems orientation to identify how multiple actors can work concurrently to address root causes that impact their respective outcomes of interest.

An example of this type of alignment is the system changes sought by the aforementioned *Magnolia Community Initiative* in Los Angeles. MCI defines health for a particular low-income subpopulation as aligning, improving and co-managing resources across sectors in the geographic area to improve health for the intended audience. MCI focuses on aspects of well-being that are the foundation for learning, productivity, social and civic functioning across a person's life, rather than focusing on one or several health conditions. Multiple sectors including child welfare, health care, education, child care, mental health, and social services all have identified common grounds in resilience and social connections, focusing on community assets rather than deficiencies to help people cope and thrive in the face of life. These sectors identified common root causes that they could address more effectively working together. The health sector focused on health behaviors and the ability to self-manage chronic health conditions such as asthma and diabetes, but all of the partners realized that despite differences in the desired downstream actions and behaviors, the human capacities of emotional well-being and ability to buffer stressors are foundational across all actors (sectors). Instead of introducing isolated interventions, MCI collaborated with local

universities and public agencies to create a system-wide learning system that supported shared measurement and a common change process.

Another example is the recent health impact assessment on a proposed free student bus pass program in Los Angeles County, where public health researchers as well as university-affiliated investigators estimated the costs and impacts of the proposal on an array of social and health outcomes (e.g., physical activity, climate implications, rates of decriminalization, school attendance), utilizing a mixed methods approach, combining key informant interviews with an analysis of regional transportation, juvenile citation, and attendance data.[49] The research was well received and widely disseminated to a variety of stakeholders and decision-makers including public health, law enforcement, social services, and advocacy organizations through the local School Attendance Task Force. This partnered research aligned with the topics and timelines of interest to decision-makers in the region and resulted in a meaningful public policy dialogue that is still gaining momentum in county.

An important lesson learned from these multi-sector efforts is the value of combining perspectives from various disciplines to consider a variety of salient outcomes and implementation issues, including costs, education, environmental factors, and downstream health impacts. Leaders in public health research and practice alike recognize the need to break down territorial silos and adopt a complex systems perspective that leverages the connectivity between sectors. This approach is essential for avoiding potential “Type 3” error where system leaders and/or investigators mistakenly conclude that something does not work because not all essential system elements needed to produce an impact were integrated as part of the base case.

Ultimately, a common theory of change, when selected and derived collaboratively among partners or sectors, should: a) lead to a better understanding of the root causes of poor health in vulnerable populations; b) foster meaningful collection and use of community-level data to inform policies and planning which address these root causes; 3) support common metrics that enable cross-learning and make it possible for public health to gauge progress of population-level interventions; and 4) facilitate the development and implementation of pragmatic action plans that are scalable and sustainable, based on evidence from DII science research.

Issue 4: Data challenges can hinder real time, practical application of research findings to policy development and program planning.

In both public health and healthcare, a major challenge to applied research is finding timely, appropriate data at the right organization- or system-level for the problem that is being addressed. Most public health indicators are available through infrequently implemented surveillance systems that can only be analyzed at the national or state level (and sometimes at a large county or city level).[50] Yet, it is at the smaller community level where changes and policies are often made and implemented. Often, public health is not able to drill down to examine specific communities, organizations, or practices in order to judge the need for or impact of policy change in targeted subgroups. In addition, it is difficult to ascertain the

impact of change processes without access to real time data points collected within close proximity to intervention implementation.

When local data, such as administrative records, are available they often lack refined (or granular) data points at the subpopulation level; in many instances, the records are simply inaccessible or incomplete.[50] In health care, the electronic health record was not designed to serve key functions for learning, which includes immediate reporting on processes and outcomes and registry functions that are needed to manage care and services at the community level. In population health systems, data about specific subpopulations are frequently not interconnected; for example, data about vulnerable children are spread throughout the education, social service, juvenile justice, and health care systems, with limited options for inter-operating. The lack of co-located data makes it difficult to judge the impacts of changes to any one of these systems on the outcomes being tracked by another.

Finally, while there is a growing interest in optimizing health and well-being, rather than focusing only on the management of specific diseases or risk factors in isolation, there is a lack of data on community assets (such as resilience, social efficacy). This stems from a traditional focus on identifying deficits and gaps (rates of disease, mental health problems, crime rates, lack of neighborhood walkability). The absence of a risk factor or deficit is not the same as the presence of a protective factor or asset in many cases.[46] Yet most national, state and local population-based surveys focus on deficits rather than assets because of variety of challenges, including lack of metrics, need to meet funding requirements, and lack of sustained community engagement.

Solution: DII sciences can guide data collection and analysis in real world settings.

Better use of existing data can involve extracting data where it exists. There are instances in which locally-collected data at the school or community level are aggregated and not reported at the school or local level. Sometimes there are privacy concerns, but in other cases the obstacle is tradition. The process of obtaining permission for researchers to use the data at the smallest unit possible can often involve onerous processes. Several local public health departments have found creative ways to pilot some of these subpopulation or community data collection efforts. The Boston Public Health Commission, for example, utilized CDC support to help augment their Boston Behavioral Risk Surveillance Survey to include more in-depth questions about housing, housing conditions, and health equity.[50] In Los Angeles County, DPH worked with the CDC and local clinic partners to conduct two rounds of a health and nutrition examination survey (LA HANES), focusing on clinical and obesity indicators for a low-income public health clinic population; this subpopulation represented the intended audiences of PSE obesity prevention interventions in the region.[18,51] These strategies began with a realization of the type and level of data that are necessary to drive change in practice at the local system level. In this regard, the principles and methods of DII sciences can be used to guide subsequent analyses of these data.

Next Steps for Public Health and CTSAs

Public health agencies and population-focused health delivery systems can partner with universities to develop a more cohesive common model of change, implement DII science

research approaches and methods that address the dynamic elements of public health practice and policy development, and improve collection and use of real world data. For example, local public health departments and local CTSA programs can work together to facilitate opportunities to advance population health through:

- Employing DII research designs that are appropriate for testing policies and programs under variable real world conditions (e.g., applying appropriate quasi-experimental designs to produce system solutions that can benefit populations).
- Involving researchers from relevant agencies (e.g., CTSAs, universities, the Veterans Affairs health system, Centers for Disease Control and Prevention, other entities within the U.S. Department of Health and Human Services) in the early design phase of population and practice-based interventions so that policy or program evaluations are set up to produce useful information for scaling and sustaining system solutions. For instance, DII science research can be used to identify and find solutions for local public health departments undergoing the Public Health accreditation process as a way to improve program and services quality.
- Providing training to researchers and public health and health professionals on DII science methods and practical ways to apply these methods in the field, by strengthening DII content in existing training programs, and offering continuing education to those already in the field. Many DII methods are consistent with the quality improvement capacities required in the newer public accreditation requirements so CTSAs could partner with public health departments to familiarize leadership and staff with these methods.[52]
- Improving access to biostatistical consultation or evaluation resources to public health-university research teams on the use of experimental and quasi-experimental methods, pragmatic trials, and complex systems science approaches that can evaluate or simulate health impacts of PSE interventions in real world settings.
- Capitalizing on local DII science initiatives, connecting and convening multi-sector partners and multi-disciplinary researchers (e.g., from medicine, public health, economics, social welfare, law, education, other public affairs disciplines) to work on real world public health problems, using multi-sector collaborations to produce comprehensive, more cohesive health programs that address health disparities in subpopulations, with renewed emphasis not just on risk and disease burden but also on population resiliency, including environmental and geo-political readiness for change.
- Identifying and securing resources, including grant funding, to help facilitate policy/program development based on rigorous DII science research – e.g., supporting pilot studies of innovations, sustaining the momentum of early collaborative efforts to implement these innovations in the community, and allowing for the time necessary to assess impact and to firmly establish the evidence base for this field of research.

Conclusions

The present article describes a number of issues in population health which pose significant challenges to traditional methods of research and evaluation. The article posits that strategic application of DII sciences within real world contexts can generate practice-based research that is more conducive to policy development and population-based planning. In this latter regard, the collaboration between public health and CTSAs is seen as a novel inter-organizational strategy for advancing DII methods – it represents a unique model of practice which can meaningfully guide public health program implementation in local communities.

Acknowledgements

The research described was supported, in part, by the National Institutes of Health /National Center for Advancing Translational Sciences through UCLA CTSI Grant Number UL1TR000124, the Southern California CTSI Grant Number UL1TR000130, and Kaiser Permanente Southern California. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

We thank Arleen Brown, MD, PhD for her review and editorial contributions to the manuscript.

References

1. Proctor EK, Landsverk J, Aarons G, Chambers D, Glisson C, Mittman B. Implementation research in mental health services: an emerging science with conceptual, methodological, and training challenges. Administration and policy in mental health. Jan; 2009 36(1):24–34. [PubMed: 19104929]
2. Marshall M, Pronovost P, Dixon-Woods M. Promotion of improvement as a science. Lancet. 2013; 381(9864):419–421. [PubMed: 23374480]
3. Holzer J, Kass N. Community engagement strategies in the original and renewal applications for CTSA grant funding. Clinical and translational science. 2014; 7(1):38–43. [PubMed: 24528898]
4. Moen, RD.; Nolan, TW.; Provost, LP. Quality Improvement through Planned Experimentation. Third. McGraw-Hill; New York, NY, USA: 1991.
5. Peters DH, Adam T, Alonge O, Agyepong IA, Tran N. Implementation research: what it is and how to do it. BMJ (Clinical research ed.). 2013; 347:f6753.
6. The Center for Research in Implementation Science and Prevention (CRISP). http://www.dissemination-implementation.org/content/aboutUs.aspx#team. Accessed June 5, 2015
7. Schillinger, D. An Introduction to Effectiveness, Dissemination and Implementation Research. University of California San Francisco; San Francisco, CA, USA: 2010.
8. Greenhalgh T, Robert G, MacFarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: Systematic review and recommendations. The Milbank Quarterly. 2004; 82(4):581–629. [PubMed: 15595944]
9. Margolis P, Provost LP, Schoettker PJ, Britto MT. Quality improvement, clinical research, and quality improvement research – Opportunities for integration. Pediatr Clin N Am. 2009; 56:831–841.
10. Perla RJ, Provost LP, Parry GJ. Seven propositions of the science of improvement: exploring foundations. Quality management in health care. 2013; 22(3):170–186. [PubMed: 23807130]
11. Rabin BA, Brownson RC, Haire-Joshu D, Kreuter MW, Weaver NL. A glossary for dissemination and implementation research in health. Journal of public health management and practice. 2008; 14(2):117–123. [PubMed: 18287916]
12. Training Institute for Dissemination and Implementation Research in Health. 2013. http://conferences.thehillgroup.com/OBSSRinstitutes/TIDIRH2013/. Accessed April 6, 2015
13. Patient Protection and Affordable Care Act, 42 USC § 4302, §9007 (2010)

14. First 5 LA in partnership with the Los Angeles County Department of Public Health. Early Childhood Obesity Prevention, Los Angeles County. Collective Impact Evaluation Planning & Considerations. First 5 LA; Los Angeles, CA, USA: 2013.
15. Fielding JE, Frieden TR. Local knowledge to enable local action. American journal of preventive medicine. 2004; 27(2):183–184. [PubMed: 15261907]
16. Luck J, Chang C, Brown ER, Lumpkin J. Using local health information to promote public health. Health affairs. 2006; 25(4):979–991. [PubMed: 16835177]
17. Bunnell R, O'Neil D, Soler R, et al. Fifty communities putting prevention to work: accelerating chronic disease prevention through policy, systems and environmental change. Journal of community health. 2012; 37(5):1081–1090. [PubMed: 22323099]
18. Robles B, Smith LV, Ponce M, Piron J, Kuo T. The influence of gender and self-efficacy on healthy eating in a low-income urban population affected by structural changes to the food environment. Journal of obesity. 2014; 2014:908391. [PubMed: 24800064]
19. Inkelas M, Brown A, Vassar S, Sankare I, Martinez A, Kubicek K, Kuo T, Mahajan A, Gould M, Mittman B. Accelerating dissemination, implementation and improvement science in CTSAs through regional partnerships. Clinical and translational science. 2015 in review.
20. Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating healthy food and eating environments: policy and environmental approaches. Annual review of public health. 2008; 29:253–272.
21. Frieden TR. A framework for public health action: the health impact pyramid. American journal of public health. 2010; 100(4):590–595. [PubMed: 20167880]
22. Preskill, H.; Parkhurst, M.; Juster, J. Guide to Evaluating Collective Impact. Parts 01 to 03. Collective Impact Forum; 2014.
23. Fallah-Fini S, Rahmandad H, Huang TT, Bures RM, Glass TA. Modeling US adult obesity trends: a system dynamics model for estimating energy imbalance gap. American journal of public health. 2014; 104(7):1230–1239. [PubMed: 24832405]
24. Zhang D, Giabbanelli PJ, Arah OA, Zimmerman FJ. Impact of different policies on unhealthy dietary behaviors in an urban adult population: an agent-based simulation model. American journal of public health. 2014; 104(7):1217–1222. [PubMed: 24832414]
25. Institute of Medicine. School Meals: Building Blocks for Healthy Children. The National Academies Press; Washington, DC, USA: 2010.
26. Robles B, Wood M, Kimmons J, Kuo T. Comparison of nutrition standards and other recommended procurement practices for improving institutional food offerings in Los Angeles County, 2010-2012. Advances in nutrition. 2013; 4(2):191–202. [PubMed: 23493535]
27. Cummings PL, Kuo T, Gase LN, Mugavero K. Integrating sodium reduction strategies in the procurement process and contracting of food venues in the County of Los Angeles government, 2010-2012. Journal of public health management and practice. 2014; 20(1 Suppl 1):S16–22. [PubMed: 24322811]
28. University of North Carolina Center for Training and Research Translation. Healthy Food Procurement in the County of Los Angeles. 2013.
29. Cummings PL, Welch SB, Mason M, Burbage L, Kwon S, Kuo T. Nutrient content of school meals before and after implementation of nutrition recommendations in five school districts across two U.S. counties. Preventive medicine. 2014; 67(Suppl 1):S21–27. [PubMed: 24631497]
30. Gase LN, McCarthy WJ, Robles B, Kuo T. Student receptivity to new school meal offerings: assessing fruit and vegetable waste among middle school students in the Los Angeles Unified School District. Preventive medicine. 2014; 67(Suppl 1):S28–33. [PubMed: 24747044]
31. Homer J, Milstein B, Wile K, Pratibhu P, Farris R, Orenstein DR. Modeling the local dynamics of cardiovascular health: risk factors, context, and capacity. Preventing chronic disease. 2008; 5(2):A63. [PubMed: 18341798]
32. Goldman DP, Cutler D, Rowe JW, et al. Substantial health and economic returns from delayed aging may warrant a new focus for medical research. Health affairs. 2013; 32(10):1698–1705. [PubMed: 24101058]

33. Fransen GA, van Marrewijk CJ, Mujakovic S, et al. Pragmatic trials in primary care. Methodological challenges and solutions demonstrated by the DIAMOND-study. BMC medical research methodology. 2007; 7:16. [PubMed: 17451599]
34. Patsopoulos NA. A pragmatic view on pragmatic trials. Dialogues in clinical neuroscience. 2011; 13(2):217–224. [PubMed: 21842619]
35. Benneyan JC, Lloyd RC, Plsek PE. Statistical process control as a tool for research and healthcare improvement. Quality & safety in health care. 2003; 12(6):458–464. [PubMed: 14645763]
36. Neuhauser D, Diaz M. Quality improvement research: are randomised trials necessary? Quality & safety in health care. 2007; 16(1):77–80. [PubMed: 17301211]
37. Lincoln, YS.; Guba, EG. Naturalistic Inquiry. SAGE Publications; Newbury Park, CA, USA: 1985.
38. Inkelas, M.; Williams, C.; Provost, L. A population health learning system to improve outcomes. Institute for Healthcare Improvement 26th Annual National Forum; Orlando, FL: Dec 9. 2014
39. Institute of Medicine (IOM) Roundtable on Evidence-Based Medicine. The Learning Healthcare System. March 20, 2007. National Academy of Sciences; Washington, DC:
40. Gase LN, Kuo T, Dunet D, Schmidt SM, Simon PA, Fielding JE. Estimating the potential health impact and costs of implementing a local policy for food procurement to reduce the consumption of sodium in the county of Los Angeles. American journal of public health. 2011; 101(8):1501–1507. [PubMed: 21680933]
41. Brown JR, Mitchell OS. Framing and claiming: How information-framing affects expected social security claiming behavior. Journal of risk insurance. 2014 in press.
42. de Marchi S, Page SE. Agent-Based Models. Annu Rev Polit Sci. 2014; 17:1–20.
43. Lavis JN, Robertson D, Woodside JM, McLeod CB, Abelson J, Knowledge Transfer Study Group. How can research organizations more effectively transfer research knowledge to decision makers? The Milbank Quarterly. 2003; 81(2):221–248. [PubMed: 12841049]
44. Leviton LC, Khan LK, Rog D, Dawkins N, Cotton D. Evaluability assessment to improve public health policies, programs, and practices. Annu rev public health. 2010; 31:213–33. [PubMed: 20235852]
45. Leppin AL, Bora PR, Tilburt JC, Gionfriddo MR, Zeballos-Palacios C, Dulohery MM, Sood A, Erwin PJ, Pablo Brito J, Boehmer KR, Mntori VM. The efficacy of resiliency training programs: A systematic review and meta-analysis of randomized trials. Plos One. 2014; 9(10):e111420. [PubMed: 25347713]
46. Plough A, Fielding JE, Chandra A, et al. Building community disaster resilience: perspectives from a large urban county department of public health. American journal of public health. 2013; 103(7): 1190–1197. [PubMed: 23678937]
47. Wells KB, Tang J, Lizaola E, et al. Applying community engagement to disaster planning: developing the vision and design for the Los Angeles County Community Disaster Resilience initiative. American journal of public health. 2013; 103(7):1172–1180. [PubMed: 23678916]
48. Gase LN, Pennotti R, Smith KD. "Health in All Policies": taking stock of emerging practices to incorporate health in decision making in the United States. Journal of public health management and practice. Nov-Dec;2013 19(6):529–540. [PubMed: 24080816]
49. Gase, LN.; DeFosset, A.; Kuo, T. The Potential Costs and Benefits of Providing Free Public Transportation Passes to Students in Los Angeles County. USA Los Angeles County Department of Public Health; Los Angeles, CA: 2013.
50. Shah SN, Russo ET, Earl TR, Kuo T. Measuring and monitoring progress toward health equity: local challenges for public health. Preventing chronic disease. 2014; 11:E159. [PubMed: 25232746]
51. Tarleton HP, Smith LV, Zhang ZF, Kuo T. Utility of anthropometric measures in a multiethnic population: their association with prevalent diabetes, hypertension and other chronic disease comorbidities. Journal of community health. 2014; 39(3):471–479. [PubMed: 24132872]
52. Riley WJ, Bender K, Lownik E. Public health department accreditation implementation: transforming public health department performance. American journal of public health. 2012; 102(2):237–242. [PubMed: 22390438]

Table 1

Summary of the Challenges, Identified Solutions, and Possible Next Steps for Public Health Departments and Clinical and Translational Science Awards Programs to Advance Dissemination, Implementation and Improvement (DII) Science Research in Population Health.

Challenge	Identified Solution	Possible Next Steps for Public Health Departments and Clinical and Translational Science Awards Programs
Research questions traditionally posed by researchers are narrowly-focused and are often not a good fit with public health practice realities, creating mismatches. • Paradigm that science should focus on service delivery, rather than policy, systems and environmental change. • Tradition and funding to evaluate interventions in isolation to assess their incremental value.	**DII sciences can be used to modify research approach.** • Research methods that assess collective impact of multiple interventions. • Development of collaborative laboratories in which public agencies, research partners, local organizations, and residents learn together and address common population health problems.	• Employ implementation and improvement research designs that are appropriate for testing policies and programs under variable real world conditions. • Involve researchers in the early design phase of population and practice interventions so that policy or program evaluations are set up to produce useful information for scaling and sustaining system solutions. Train scientists and provide ongoing training or continuing education to public health and health professionals in that impact population health. • Provide biostatistical consultation or evaluation resources to public health-university research teams on the use of experimental and quasi-experimental methods, pragmatic trials, time-series analysis, and complex systems science approaches. • Connect and convene multi-sector partners and multi-disciplinary researchers to work on real world public health problems, using multi-sector collaborations to produce comprehensive, more cohesive health programs.
Processes associated with iterative learning and innovations are dynamic and may be difficult to study in the real world. • Public health challenged to implement interventions in complex systems (e.g., multiple interventions, uncertain events and implementation timelines). • Lack of available true “baseline” data.	**Develop and utilize DII methods that fit the dynamic elements of the policy or real world environment.** • Research methods that embrace complexity, including pragmatic trials, time-series, statistical process control methods, quality improvement and emergent design methods, and complex systems science.	
Selection and application of a common theory of change to guide population and system-wide approaches is often lacking in public health planning. • Need for public health to implement mutually-reinforcing services and supports from different sectors to reduce duplication and siloed efforts. • Research and funding agency nomenclature, autonomous work, and single disease/issue focus.	**DII sciences can help promote synergies in policies and public health practice by aligning theories of change with common indicators across conditions and sectors.** • Use of a common theory of change that identifies shared elements across frameworks. • Use of multi-agency collaborations to consider perspectives from various disciplines.	
Data challenges can hinder real time, practical application of research findings to policy development and program planning.	**DII sciences can guide data collection and analysis in real world settings.**	

Challenge	Identified Solution	Possible Next Steps for Public Health Departments and Clinical and Translational Science Awards Programs
• Lack of timely, appropriate data at the right level to influence and evaluate policy, systems and environmental changes. • Lack of data on community assets.	• Overcome barriers to use of locally-collected data (e.g., privacy). • Identify ways to augment local data-collection systems. • Integrate data systems across sectors/partners.	