11-2012

Expanding Delivery System Research in Public Health Settings: Lessons From Practice-Based Research Networks

Glen P. Mays
University of Kentucky, glen.mays@cuanschutz.edu

Rachel A. Hogg
University of Kentucky, rachel.hogg@uky.edu

Expanding Delivery System Research in Public Health Settings: Lessons From Practice-Based Research Networks

Digital Object Identifier (DOI)
https://doi.org/10.1097/PHH.0b013e31825f75c9

Notes/Citation Information
Published in *Journal of Public Health Management and Practice Issue*, v. 18, no. 6, p. 485-498.

Published in final edited form as:
J Public Health Manag Pract. 2012 November ; 18(6): 485–498. doi:10.1097/PHH.0b013e31825f75c9.

Expanding Delivery System Research in Public Health Settings: Lessons from Practice-Based Research Networks

Glen P. Mays, PhD., M.P.H. and
Department of Health Services Management College of Public Health University of Kentucky Lexington, KY

Rachel A. Hogg, M.A.
Department of Health Services Management College of Public Health University of Kentucky Lexington, KY

Abstract

BACKGROUND—Delivery system research to identify how best to organize, finance, and implement health improvement strategies has focused heavily on clinical practice settings, with relatively little attention paid to public health settings – where research is made more difficult by wide heterogeneity in settings and limited sources of existing data and measures. This study examines the approaches used by Public Health Practice-Based Research Networks (PBRNs) to expand delivery system research and evidence-based practice in public health settings.

METHODS—PBRN research networks employ quasi-experimental research designs, natural experiments, and mixed-method analytic techniques to evaluate how community partnerships, economic shocks, and policy changes impact delivery processes in public health settings. Additionally, network analysis methods are used to assess patterns of interaction between practitioners and researchers within PBRNs to produce and apply research findings.

RESULTS—Findings from individual PBRN studies elucidate the roles of information exchange, community resources, and leadership and decision-making structures in shaping implementation outcomes in public health delivery. Network analysis of PBRNs reveals broad engagement of both practitioners and researchers in scientific inquiry, with practitioners in the periphery of these networks reporting particularly large benefits from research participation.

CONCLUSIONS—Public Health PBRNs provide effective mechanisms for implementing delivery system research, engaging practitioners in the process, and accelerating the translation and application of research findings into public health settings.

Introduction

Current policy initiatives to contain costs and improve outcomes within the U.S. health system include efforts to expand strategies that promote health and prevent disease and injury on a population-wide basis. Because more than 75 percent of current health care expenditures are attributable to diseases that are largely preventable, the expanded delivery

Source: Authors' analysis of survey data from participants in the first five public health PBRNS to become operational in the U.S., 2010

of public health and prevention strategies holds considerable potential for reducing disease burden and constraining the growth in national health spending.[1] Recognizing this potential, the Patient Protection and Affordable Care Act of 2010 created the Public Health and Prevention Fund and authorized up to $15 billion in federal spending on public health and prevention strategies over the next decade. This component of federal health reform has remained controversial, in large part because of uncertainties about its effectiveness in achieving health reform goals.

Achieving meaningful health and economic benefits from such investments requires knowledge about what public health and prevention strategies actually work to improve health and how to deliver these strategies to the populations that can benefit from them. The nation's health sciences research enterprise offers an expanding body of research-tested programs, policies, and interventions that have been shown to promote health and prevent disease and disability, such as those profiled in the CDC's *Guide to Community Prevention Services*.[2] Unfortunately, studies from the past three decades have found evidence of wide variation in the adoption and implementation of evidence-based public health strategies across states and communities despite an expanding evidence base.[3] At the same time, public health professionals routinely take action against health problems for which few if any evidence-based strategies exist, or for which the available evidence-based strategies prove to be logistically, politically or economically infeasible. In these cases, innovations and adaptations in public health practice occur, but often without the comparative research necessary to determine their effectiveness.

These missed opportunities for evidence-based practice and practice-based evidence call attention to a dearth of “delivery system research” that sheds light on how best to organize, finance, and deliver public health strategies in real-world practice settings.[4,5] Of the limited number of studies that examine implementation and delivery issues within the health system, many focus on clinical practice settings and medical care providers, with relatively little attention paid to public health settings. The need for delivery system research in public health is particularly acute given the high degree of heterogeneity and complexity found in public health delivery systems. Public health strategies are implemented through the combined efforts of multiple governmental public health agencies and their private-sector and community-based counterparts, through relationships and resources that vary widely across states and communities and that evolve over time.[6] Programs and policies that are easily implemented in one setting may face economic, political, geographic, or socio-cultural barriers in another setting.[7] Expanded delivery system research is needed in public health settings to elucidate which strategies work best in which settings and for which populations. This research can identify pathways for improving delivery systems and for adapting public health strategies in ways that optimize the use of resources for promoting population health.

In an effort to expand delivery system research in public health settings, the Robert Wood Johnson Foundation launched the Public Health Practice-Based Research Networks Program in 2008. Public health practice-based research networks (PBRNs) bring together public health agencies and academic researchers to study the organization, financing, and delivery of public health strategies in real-world practice settings, with the goal of producing

actionable evidence that can be used to improve practice and policy.[8] This paper examines the experience of PBRNs in organizing, implementing, and translating delivery system research in public health settings during their initial three years of development. Findings indicate that the networks have developed a variety of successful mechanisms for identifying practice-relevant research opportunities and for implementing studies rapidly in practice settings. While some networks already have made progress in translating PBRN research findings in to policy and delivery system changes, many additional opportunities exist for PBRNs to move research into meaningful public health action.

Background: Practice-Based Research Networks

Practice-based research networks (PBRNs) have been used in medical care research for more than three decades to support delivery system research in clinical settings. PBRNs allow community-based health care providers and their staffs to collaborate with researchers in designing, implementing, evaluating, and diffusing solutions to real-world problems in clinical practice.[9,10] Successful PBRNs identify relevant clinical questions and link them with rigorous research methods applied within community settings. The result of this collaboration is scientific information that is relevant to practice, externally valid, and readily assimilated into other settings.[11] Clinical PBRNs have expanded rapidly in recent years as they have become increasingly central to the quality improvement initiatives promoted by federal health agencies and national medical societies.[12] The U.S. Agency for Healthcare Research and Quality (AHRQ) has worked since 1999 to establish such networks among primary care practices, where they have become central components of scientific efforts to encourage the diffusion of evidence-based clinical practices and the adoption of new technologies to improve quality of care. Other networks have developed with support from the U.S. Health Resources and Services Administration and medical specialty societies such as the American Academy of Pediatrics and the American Academy of Family Physicians. Hospital-based PBRNs also have emerged to support quality improvement research in selected medical specialty areas, such as the Vermont Oxford network of neonatal intensive care units. More recently, AHRQ has extended the PBRN concept to research networks involving health plans and integrated health care delivery systems, and networks for dental care, mental health care, and school nursing also have developed. Although not all PBRNs succeed in becoming viable research enterprises, collectively these networks are responsible for producing a large and growing body of evidence around strategies for improving health outcomes and quality of care in real-world practice settings. More than 110 primary care PBRNs currently operate in the U.S., supported by a diverse mix of federal and private clinical research funding.[13]

The experience of the PBRN model in clinical settings suggests that it may also be useful in public health settings to accelerate the production and application of evidence regarding public health delivery. A public health PBRN brings multiple public health agencies together with research partners to design and implement comparative studies of alternatives for organizing, financing, and delivering public health strategies intended to prevent disease and injury and promote health.[8] Participating practitioners and researchers collaborate to identify pressing research questions of interest, design rigorous and relevant studies, execute research effectively, and translate findings rapidly into practice. As such, PBRNs represent

vehicles for expanding the volume and quality of practice-based research needed for evidence-based decision-making in public health. In keeping with concepts of participatory research, findings produced through PBRNs are expected to be readily translated and adopted into routine public health decision-making because practitioners are actively involved throughout the research process.

The Robert Wood Johnson Foundation's Public Health PBRN Program is the first national initiative in the U.S. to develop PBRNs for research in public health practice settings. Launched in 2008, the Public Health PBRN Program currently supports 12 research networks comprised of local and state governmental public health agencies, community partners, and collaborating academic research institutions. These supported PBRNs are located in Colorado, Connecticut, Florida, Kentucky, Massachusetts, Minnesota, Nebraska, New York, North Carolina, Ohio, Washington, and Wisconsin (Figure 2). Additional public health PBRNs participate in the program as affiliate members and emerging networks under development, with the affiliate networks in Georgia, Missouri, Tennessee and New Jersey progressing to the point of receiving research support from the PBRN Program. Counting both supported and affiliate networks, public health PBRNs are currently operational in 25 states and cover more than 900 state and local public health agencies across the U.S. The National Coordinating Center for the Public Health PBRN Program, based at the University of Kentucky, provides resources and technical assistance to the networks for developing implementing, and translating research projects. The Coordinating Center also organizes cross-cutting and multi-network research studies designed to evaluate and compare public health strategies implemented across diverse practice settings.

Methodology And Data

This study assesses the progress of public health PBRNs in designing and implementing practice-relevant, delivery system research studies during their initial three years of development. Data from several different qualitative and quantitative sources are used to assess PBRN progress with research implementation. First, descriptive data on the organizational composition and structure of each public health PBRN were obtained from a review of grant proposals and annual progress reports submitted by the networks during 2009-11. These documents, along with the research products submitted by each network, provided information on the number and types of research projects implemented by each public health PBRN. Second, key-informant interviews were conducted with the network leaders and managers of each PBRN to assess their experiences with developing, and implementing research projects through the networks and disseminating and translating research findings.

Finally, a web-based survey of all participants in five public health PBRNs was conducted to collect quantitative measures of network composition, activities, and experiences. The five networks included in the survey comprise the first cohort of PBRNs to become operational in December of 2008. The survey targeted 112 individuals who were identified by network leaders as being active in one of the five PBRNs by virtue of (1) serving on a governing board or steering committee for the network; (2) attending regular organizational or planning meetings of the network; and/or (3) participating in the design, implementation, or

dissemination of a research project conducted through the network. The survey instrument asked respondents to indicate their frequency and types of participation in PBRN research activities, frequency of interaction with other PBRN participants for research and non-research purposes, and perceived benefits and costs of participating in the network. After pilot testing and validating the instrument via cognitive interviews, the survey was fielded during 2010, approximately 1.5 years after each network began operations (response rate 67%). Descriptive statistics from the PBRN participation measures are summarized overall and compared across the five networks to identify areas of similarity and divergence. Additionally, standard measures of network analysis—network density and organizational centrality—are used to assess key patterns of interaction among the research and practice organizations within each network.

Results

Network Composition and Structure

Five core organizational components exist in most of the public health PBRNs operating in the U.S. to date: local health departments, state health departments, academic institutions, public health professional associations, and community-based organizations. The prevalence and position of these five components varies widely across networks, giving rise to considerable heterogeneity in PBRN structure. Among the 12 public health PBRNs supported by the Robert Wood Johnson Foundation (the supported networks), two are organized and led by local health departments, three are led by state health departments, four are led by professional associations, and three are led by academic institutions (Table 1). Local health departments comprise the single largest organizational component of public health PBRNs, representing 90% of the 356 participating organizations in the 12 supported networks and 4 affiliate networks with active research projects. All of the networks include multiple local health departments so as to create opportunities comparative research studies across multiple practice settings. However, the number of participating local health departments varies widely across networks, ranging from less than 10 departments in the Washington and North Carolina PBRNs, to more than 100 departments in Ohio. In contrast, most networks include only a single state health department, academic institution, and professional association. Notable exceptions to this structure exist in Ohio, where all five of the state's academic public health programs and two of the state's nursing schools participate in the PBRN, and in Colorado, where 10 professional associations and three university campuses engage in the network. The Colorado PBRN is also notable for the multiple community-based organizations participating in the network.

The geographic areas covered by public health PBRNs uniformly fall within state boundaries at the present time. Three-fourths of the 12 supported PBRNs cover a statewide area that includes both rural and urban public health jurisdictions, while the remaining networks cover either a defined geographic region within a state or the noncontiguous service areas of a selection of local health departments within a state. PBRN leaders report that their single-state structures offer clear advantages during the early stages of network development, including high levels of familiarity and interaction among network participants, convergence in research interests, and geographic proximity for meetings. None

of the existing PBRNs currently covers a multi-state or nation-wide area, but two networks anticipate expanding their membership beyond their current state boundaries in order to include larger numbers and variety of practice settings in their research.

Governance and decision-making processes for public health PBRNs typically derive from a steering committee comprised of representatives of the participating academic institutions and public health practice agencies. Most of the supported public health PBRNs have adopted formal charters that delineate steering committee membership and appointment processes, roles and responsibilities of member organizations, and standard decision-making processes such as how research projects are identified, prioritized, and approved and how research funding is distributed within the network. In most cases, the network's senior administrative leadership and core staff positions are filled by individuals employed by the lead organization within the network. The lead organization also serves as the principal financial intermediary for the network. In many cases, the PBRN also designates a research co-director filled by a senior scientist from a participating academic or research institution.

Network Participation and Engagement

A survey of participants in the initial five public health PBRNs to become operational in the U.S. reveals high levels of engagement in PBRN activities from both public health practitioners and academic researchers, but some notable differences in the types of PBRNs activities in which they engage (Table 2). Approximately 30% of the respondents are affiliated with an academic research institution, with the remainder affiliated with governmental public health agencies, professional associations, or community-based organizations (collectively classified as public health practitioners). Practitioners are somewhat more likely than academics to report attending regular meetings and conference calls of the PBRNs, but almost half as likely as academics to report participating in the implementation of research activities. The PBRN activity most likely to engage practitioners is identifying research topics and ideas for the PBRN to pursue (46% of practitioners participate), whereas the activity most likely to engage academics is designing and planning research studies (41% of academics). Practitioners were somewhat more likely than academics to engage in applying PBRN research findings within their own organizations (15% vs. 9%), but less likely to help other organizations apply such findings (13% vs. 23%). These patterns of engagement roughly correspond with self-reported levels of prior experience, with academics reporting more past experience with research design and implementation, and practitioners reporting more past experience with research application.

The practitioners and academics involved in PBRNs showed notable similarities in their perceived benefits of participating in the networks (Table 3). Among academics, the highest-rated perceived benefit of participating in the PBRN was the ability to steer research activities toward more relevant topics and questions. Among practitioners, however, this was only the second-highest perceived benefit, surpassed by the opportunity to identify strategies for improving public health practice, and followed closely by the opportunity to identify innovations in public health practice. . Among academics, the second-highest perceived benefit was realized in helping other organizations improve public health practice, followed by the opportunity to identify innovations in practice. Large majorities of both

groups of PBRN participants expressed agreement with the conclusion that the benefits of PBRN participation outweigh the costs of participation. Similarly, both groups reported a high likelihood of continuing their PBRN participation and participating in future PBRN studies.

Patterns of Interaction within Networks

The patterns of interaction among public health practice agencies and academic institutions participating in public health PBRNs can be examined using commonly used measures of network analysis. These measures characterize the centrality (or influence) of individual organizations participating within the PBRN, and also delineate the structure of each PBRN's network as a whole. Two organization-level measures of centrality are used for this purpose: *degree centrality* indicates the sheer number of connections that an organization maintains with other organizations in the network; and *betweeness centrality* indicates the extent to which an organization serves as a link or bridge to different parts of the network that would otherwise not be connected. For each PBRN network as a whole, two measures of structure are used: (1) *network density* measures the degree of interconnectedness within the network based on the ratio of the observed number of links between organizations to the total possible number of links; and (2) *network centrality* measures the extent to which a network is dominated by a small number of hub organizations through which most interaction occurs.

These network measures reveal considerable variation in patterns of interaction within the first five public health PBRNs to become operational in the U.S. Organizations participating in the Washington and North Carolina networks show the highest levels of degree centrality, suggesting extensive connectedness and cohesion among the organizations within these networks (Table 4). Organizations participating in the Colorado network show the highest levels of betweeness centrality, indicating the role of key organizations in bridging isolated regions of the network. The Kentucky and Colorado networks display relatively low levels of network centrality compared to the other three networks, indicating that these networks are less dependent on “hub” organizations to coordinate and facilitate interaction. Across all five networks, academic institutions show higher levels of degree centrality and betweeness centrality compared to practice-based organizations, indicating the important roles they play in coordinating interaction and linking organizations together within the networks.

The structural diversity of the five PBRNs can also be seen visually in the graphical depictions of each network's patterns of interaction (Figure 2). Kentucky and Colorado are notable for the many peripheral organizations that are loosely connected to the networks through single relationships and relatively infrequent interaction—potentially allowing the network to tap into new and diverse perspectives through these connections, but also potentially requiring more effort to maintain the engagement of these peripheral stakeholders. By contrast, the North Carolina and Washington networks exhibit a high degree of interconnectedness among organizations with few peripheral participants—potentially facilitating rapid information flow, decision-making, and collective action. The Massachusetts network exhibits a hybrid structure of sorts, including a subgroup of

organizations with high interconnectedness along with a smaller number of peripheral organizations. The bridging role played by academic institutions is visible in most PBRNs.

Scope and Scale of Research

Public health PBRNs identify research opportunities by tapping the local knowledge, information needs, and uncertainties of their participating public health practitioners and practice settings. Converting these identified needs and opportunities into viable research projects, however, requires alignment with the skills and interests of participating researchers, the priorities of funding organizations and policy decision-makers, and the availability of adequate study settings and data resources. Most of the supported PBRNs take steps to facilitate this alignment, such as periodically canvassing network participants about their research needs and interests, monitoring extramural funding opportunities, and inventorying locally-available data resources. Network leaders report using a combination of strategic and opportunistic approaches to developing research projects, some of which form wholly from practitioner needs and uncertainties, and others that are shaped heavily by researcher interests, funding opportunities, and issues on the local or national policy agenda. In each instance, networks must strike a balance among practical relevance, methodological rigor, logistical feasibility and cost, and salience for funders and policy decision-makers.

A total of 45 individual research projects have been launched through 12 supported PBRNs and 2 affiliate PBRNs as of early 2012. One quarter of these projects are small-scale, proof-of-concept studies that allowed networks to gain experience working together, demonstrate the functionality of the network, and generate preliminary data that inform the design and implementation of larger future studies. These studies, called preliminary investigation projects, use descriptive, cross-sectional designs and involved secondary analysis of existing data sources and/or collection and analysis of qualitative data from a limited number of practice settings. Another 40 percent of PBRN studies involve larger-scale, comparative research designs that examine variation in public health practice patterns across multiple settings, test the implementation or impact of new public health strategies in multiple settings, or investigate the effects of changes in policy or administrative actions. These studies use a mix of quantitative and qualitative analytic approaches, a combination of primary data collection and secondary data analysis, and longer implementation periods ranging from 18 to 24 months. The study designs and methodological approaches vary widely depending on the research opportunity at hand, including a prospective randomized trial, several concurrent natural experiments, and a retrospective, observational study using propensity-score matched comparison group. A third group of studies pursue short-term, rapid-cycle investigations of emerging issues in public health practice and policy. These quick-strike studies, comprising the remaining one-third of the PBRN research portfolio, are small in scale, implemented in 3-6 months, and designed to produce findings on time-sensitive issues that can inform pending public health decisions and future directions for research.

The topics addressed by public health PBRN studies to date cluster around four predominant themes that reflect significant drivers of change and innovation within public health delivery systems across the nation (Table 5). One group of PBRN studies examines the effects of

economic shocks, financing changes, and resource allocation decisions on public health delivery (Table 2). PBRN interest in these issues is not surprising given that network formation has taken place in the midst of one of the largest and longest economic recessions in U.S. history, creating unique opportunities for comparing public health system responses and consequences. For example, the Connecticut PBRN has a two-year study underway that examines the effects of a policy change that eliminated state subsidies to local health departments serving jurisdictions with fewer than 50,000 residents. The study monitors effects on the scope and intensity of public health services delivered and on efforts to regionalize or coordinate the public health activities of small jurisdictions. In North Carolina, the PBRN is studying the effects of a Medicaid reimbursement change that reduced and capitated payments to local health departments for providing case management services for high risk mothers and infants, focusing on changes in clients reached and services delivered along with avoidable medical care utilization and costs. In both Washington and New York, networks are studying which public health services are reduced or eliminated in response to budgetary pressures and what factors are considered when making these decisions at state and local levels.

A second cluster of PBRN studies examine the implementation and impact of multijurisdictional public health delivery models involving regionalization, consolidation, and shared services among local public health agencies. Many of these new delivery models are forming in response to the economic downturn and the resulting pressures to reduce costs and improve efficiency in public health delivery, while in other cases agencies are testing these models to enhance their ability to meet the newly developed national public health accreditation standards. The Massachusetts PBRN is studying local public health responses to an innovative state program that uses federal National Public Health Improvement Initiative funding to incentivize the development of regional public health delivery models among small local health departments and health boards. The Wisconsin network has a retrospective study underway to compare the structural and functional characteristics of multi-jurisdictional shared-service models used for local public health delivery in this state, while studies underway in the Nebraska and Georgia networks examine the effectiveness of multi-county and regional approaches to quality improvement and accreditation preparation in local public health settings.

A third, closely-related group of PBRN studies investigate the drivers and determinants quality in public health practice, with a specific focus on the adoption and implementation of evidence-based practices, the use of quality improvement (QI) techniques, and the influence of accreditation standards and decision supports. In this domain, the Colorado PBRN is examining the influence of local community health coalitions on the adoption and implementation of evidence-based policy and environmental strategies for obesity prevention. The Kentucky network is testing the effectiveness of a QI intervention delivered by local health departments to promote adherence to evidence-based practices for diabetes prevention and management in clinical and community settings. And the Ohio network is testing a novel direct-observation method to examine local variation in food-borne outbreak prevention and management practices across local health departments, and to identify strategies for reducing unwarranted variation.

A final cluster of PBRN studies address disparities in the delivery of public health services and strategies used within public health delivery systems to reduce health disparities. Recognizing that much of the existing health disparities research focuses on contributing factors and interventions within the medical care system, these PBRN studies seek to identify new solutions through public health systems and services. In Minnesota, a statewide study is underway to categorize the types of strategies currently being used by local health departments to address health disparities, and identify factors that facilitate and impede the implementation of these activities. The Kentucky network is conducting a randomized trial to test the effectiveness of a cultural competency training intervention aimed at local health department personnel across the state. In a similar vein, the Washington network is testing the effectiveness of a QI intervention designed to promote diversity in hiring practices within a local health department.

Research Dissemination, Translation, and Application

The predominant theory of PBRNs holds that if relevant practice settings are actively engaged in the selection, design, and execution phases of scientific inquiry, then findings from the research will be adopted into practice more rapidly and widely than with traditional academic models of research implementation. The empirical evidence supporting this theory remains surprisingly shallow despite several decades of experience with PBRN implementation in clinical settings. Although public health PBRNs are comparatively very early in their experience with research implementation, there are growing numbers of examples of how successful research dissemination and translation activities are occurring for practice and policy stakeholders. For example, early results from a Colorado PBRN study of the effects of the state's public health reform law on regional approaches to public health service delivery have been used by the network to provide technical assistance and direction to local public health jurisdictions both inside and outside the state that are developing multi-jurisdictional delivery models. These results also proved highly influential in the state government's decision to maintain funding for implementation of the state public health law despite sharp shortfalls in state revenue during the economic recession. In both North Carolina and Kentucky, rapid-cycle studies of local variation in the public health response to the novel H1N1 influenza outbreak during 2009 identified opportunities for improving communication between medical providers, public health officials, and others – allowing for mid-course corrections in response activities over the course of the outbreak. In Ohio, a PBRN study of local variation in enforcement of the state's clean indoor air law called attention to gaps in state and local funding for enforcement activities, opening up a dialogue with the state health department and the state attorney general's office to identify new mechanisms of support. And in Washington, a recent PBRN study that documented unwarranted variation in local communicable disease control practices has prompted both state and local public health agencies to update their practice guidelines and protocols and to institute enhanced monitoring of practices and outcomes.

PBRN leaders attribute their early successes with research dissemination and translation in part to the tailored communication strategies developed by the networks. Rather than relying on traditional journal articles and presentations at scientific meetings as the primary mechanisms of dissemination, many PBRNs prioritize the early communication of

preliminary results through presentations at local and state public health meetings and webinars, testimony before legislative committees and boards of health, and tailored research briefs and decision guides produced specifically for public health practice and policy audiences. One PBRN leader noted an explicit strategy to create an "echo chamber" around its research results by providing top-line summaries and talking points regarding findings and practical implications to influential members of the network, who can then relay these key messages to other stakeholders and audiences around the state.

The National Coordinating Center for the Public Health PBRN Program has launched additional mechanisms to accelerate the dissemination of PBRN findings on a broad national scale. These mechanisms include a research-to-action podcast that features PBRN researchers being interviewed by public health practitioners about the practice and policy implications of their studies. Additionally, a new open-access, online publication has been launched, Frontiers in Public Health Services and Systems Research, that features brief summaries of emerging research findings and their practice implications –loosely modeled after the *Morbidity and Mortality Weekly Report* produced by the CDC to disseminate emerging epidemiological findings. These new strategies, feely accessible to public health practice and policy audiences via the web,[1] are designed to augment the more localized dissemination and translation strategies being used by individual PBRNs.

Conclusions

Public health PBRNs have made rapid progress in expanding the amount of delivery system research being conducted in public health settings across the U.S. Although the most established of these networks are barely three years old, the PBRNs have achieved notable success in bridging the academic-practice divide and forging productive collaborations to produce new evidence about the organization, financing, and delivery of public health strategies. Looking forward, several strategies are likely to be important to the continued development of public health PBRNs and the utility of the evidence they produce. First, PBRNs need to develop additional capacity to implement large-scale research projects that provide more definitive empirical evidence (stronger internal validity) and that generalize to broad, national populations of public health practice settings (stronger external validity). Presently, most public health PBRNs include less than 100 public health practice settings, yielding sample sizes that may be insufficient for detecting the effects of policy, program, and system changes – particularly when settings are clustered within districts or regions, when outcomes are rare, and when system changes exhibit heterogeneous effects. One way that PBRNs can address this limitation is to forge alliances among multiple networks and implement common research studies across multiple PBRNs. As another strategy, selected PBRNs may expand into multi-state, regional, or national PBRNs that engage practice settings across larger geographic areas. Both of these strategies have been used successfully by clinical PBRNs to increase the number and diversity of medical practice settings represented in research.

[1] www.publichealthsystems.org

Additionally, public health PBRNs need to cultivate new opportunities for studying the effects of new delivery system strategies that involve coordination and integration between public health and medical care delivery settings. Many of the current PBRN studies focus on traditional public health agency responsibilities such as community health assessment and surveillance, communicable disease control, and chronic disease prevention. However, public health agencies are beginning to forge new roles in implementing health promotion and disease prevention strategies in the context of accountable care organizations, patient-centered medical home models, hospital readmission prevention and community benefit programs, health insurance exchanges, and other new health care delivery models.[14] Research on the implementation and impact of these new models is urgently needed to guide the future directions of health system reform, and public health PBRNs are well positioned to play key roles in this research. To carry out this research effectively, public health PBRNs will need to forge expanded alliances with medical care settings and with the existing research enterprises that engage these settings, such as primary care PBRNs, hospital and HMO research networks, prevention research centers, NIH-supported Clinical and Translational Science Award centers, and centers of excellence in health disparities research. These types of alliances will allow public health PBRNs to build on their successful record of collaborative research with public health settings and learn from the innovations that now seek to bridge the existing discontinuities between medical care and public health delivery systems. The result promises help the health system as a whole optimize the deployment of its resources to achieve greater gains in population health.

Acknowledgments

This research was funded by the Robert Wood Johnson Foundation (Grant #64676). Glen Mays also was supported through a Clinical and Translational Science Award from the National Institutes of Health (Award 1UL1RR029884).

References

1. Centers for Disease Control and Prevention (U.S.). Chronic diseases: the power to prevent, the call to control. CDC; Atlanta, GA: 2009.
2. Briss PA, Brownson RC, Fielding JE, Zaza S. Developing the Guide to Community Preventive Services: Lessons Learned About Evidence-Based Public Health. Annual Review of Public Health. 2004; 25:281–302.
3. Mays GP, Smith SA, Ingram RC, Racster LJ, Lamberth CD, Lovely ES. Public health delivery systems: evidence, uncertainty, and emerging research needs. Am J Prev Med. 2009; 36:256–65. [PubMed: 19215851]
4. Scutchfield FD, Mays GP, Lurie N. Applying health services research to public health practice: an emerging priority. Health Serv Res. 2009; 44:1775–87. [PubMed: 19686256]
5. Green LW. Public health asks of systems science: to advance our evidence-based practice, can you help us get more practice-based evidence? Am J Public Health. 2006; 96:406–9. [PubMed: 16449580]
6. Mays GP, Scutchfield FD, Bhandari MW, Smith SA. Understanding the organization of public health delivery systems: an empirical typology. Milbank Q. 2010; 88:81–111. [PubMed: 20377759]
7. Brownson RC, Ballew P, Dieffenderfer B, et al. Evidence-based interventions to promote physical activity: what contributes to dissemination by state health departments. Am J Prev Med. 2007; 33:S66–73. quiz S4-8. [PubMed: 17584593]
8. Mays GP. Leading improvement through inquiry: practice-based research networks in public health. Leadership in Public Health. 2011:1–5.

9. Thomas P, Griffiths F, Kai J, O'Dwyer A. Networks for research in primary health care. BMJ. 2001; 322:588–90. [PubMed: 11238155]

10. Thomas P, Kai J, O'Dwyer A, Griffiths F. Primary care groups and research networks: opportunities for R&D in context. The British Journal of General Practice : the Journal of the Royal College of General Practitioners. 2000; 50:91–2. [PubMed: 10750202]

11. Fraser I, Lanier D, Hellinger F, Eisenberg JM. Putting practice into research. Health Serv Res. 2002; 37:xiii–xxvi. [PubMed: 11949929]

12. Mold JW, Peterson KA. Primary care practice-based research networks: working at the interface between research and quality improvement. Annals of Family Medicine. 2005; 3(Suppl 1):S12–20. [PubMed: 15928213]

13. Green LA, White LL, Barry HC, Nease DE Jr. Hudson BL. Infrastructure requirements for practice-based research networks. Annals of Family Medicine. 2005; 3(Suppl 1):S5–11. [PubMed: 15928219]

14. Stine NW, Chokshi DA. Opportunity in austerity--a common agenda for medicine and public health. N Engl J Med. 2012; 366:395–7. [PubMed: 22296074]

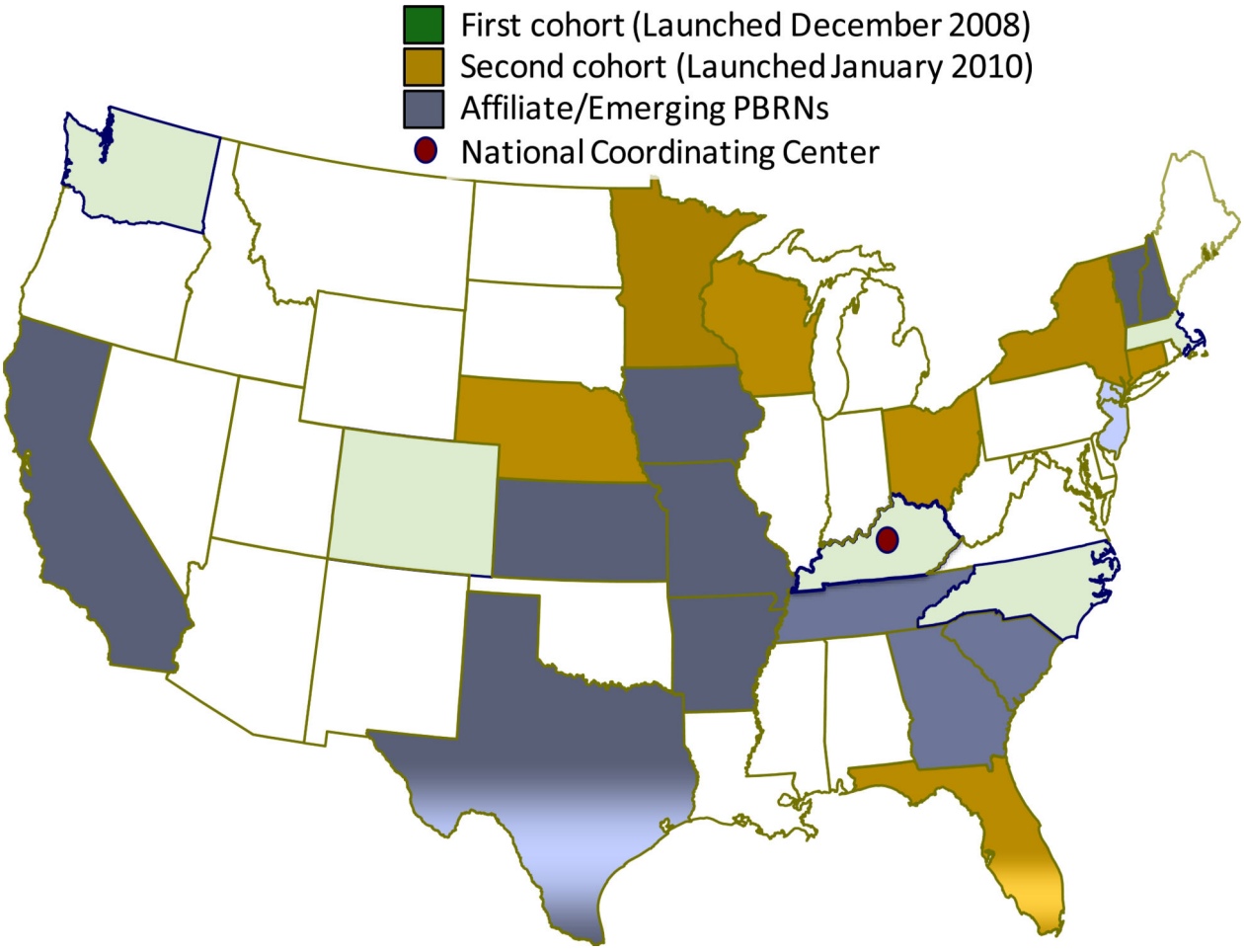

Figure 1.
Geographic Locations of Public Health PBRNs in the U.S., 2012

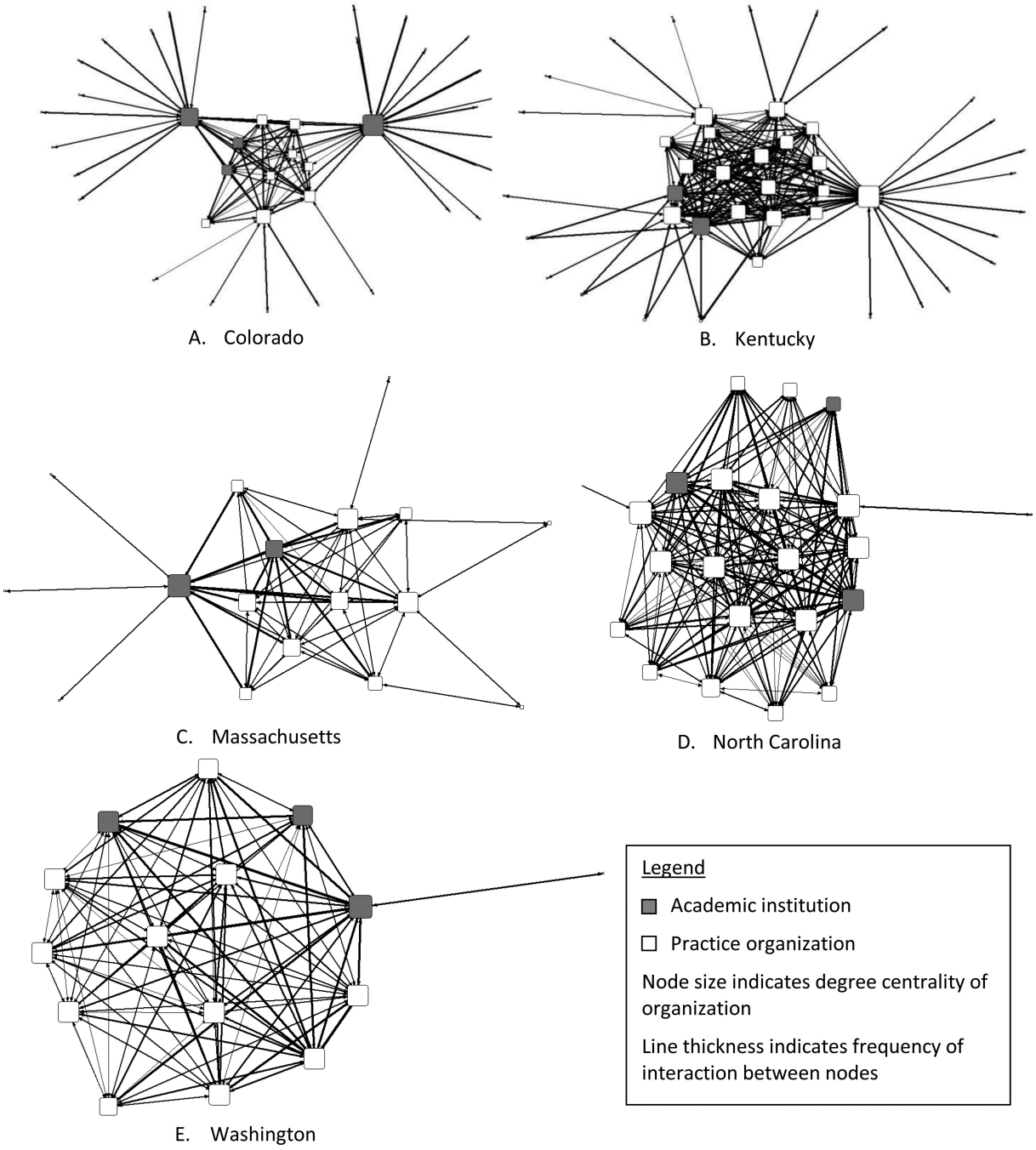

Figure 2.
Network Structures of Five Public Health PBRNs

Table 1

Organizations Participating in the Public Health PBRN Program, 2012

Network	State Agencies	Local Agencies*	Academic Units	Other	Total	Lead Institution
I. Supported Networks						
CO	1	55	2	15	73	Association
CT	3	40	3	5	51	Association
FL	1	67	3	3	74	Local agency
KY	1	56	1	1	59	Association
MA	1	15	1	2	19	Academic
MN	1	75	1	1	78	State agency
NC	2	8	1	1	12	Academic
NE	2	12	1	2	17	State agency
NY	1	56	3	2	62	State agency
OH	1	115	6	3	125	Academic
WA	1	36	2	1	40	Local agency
WI	1	42	3	2	48	Association
II. Affiliate Networks with Funded Projects						
GA	1	118	1	6	126	Academic
MO	1	115	3	1	120	Association
NJ	1	100	2	1	104	Academic
TN	1	16	2	1	20	Academic
Total	20	926	35	47	1028	

Source: authors' analysis of PBRN grant applications and research progress reports

* Local public health agencies/units currently participating in PBRN research projects or included in PBRN studies

Table 2

Participant Characteristics in Five Public Health PBRNs

Participant Characteristics	All	Practitioners	Academics
Organizational affiliation(s)			
Academic institution	29.73%	0.00%	100.00%
State agency	9.46%	9.62%	9.09%
Local agency	56.76%	80.77%	0.00%
Federal agency	1.35%	1.92%	0.00%
Professional association	8.11%	11.54%	0.00%
Community-based organization	6.76%	7.69%	4.55%
Types of PBRN participation			
Core staff member	21.62%	13.46%	40.91%
Member of PBRN committee	58.11%	55.77%	63.64%
Representative of a member organization	16.22%	17.31%	13.64%
Attend regular meetings/calls	68.92%	71.15%	63.64%
Participate in research implementation	45.95%	36.54%	68.18%
Contributed to PBRN activities >1 time in past year			
Identifying research topics/ideas	44.00%	46.15%	36.36%
Designing/planning studies	36.00%	32.69%	40.91%
Seeking funding for studies	29.33%	26.92%	31.82%
Implementing research studies	24.00%	23.08%	22.73%
Disseminating findings	21.33%	21.15%	18.18%
Applying findings within own organization	14.67%	15.38%	9.09%
Helping others apply findings	17.33%	13.46%	22.73%
Prior public health research experience[1]	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)
Identify research topics/priorities	3.38 (0.98)	3.14 (0.96)	3.95 (0.79)
Design/plan studies	2.99 (1.20)	2.65 (1.11)	3.77 (1.02)
Seek research funding	2.96 (1.18)	2.63 (1.11)	3.73 (0.98)
Implement research studies	2.96 (1.23)	2.54 (1.07)	3.91 (1.02)
Disseminate research results	3.29 (1.11)	3.08 (1.13)	3.77 (0.92)
Apply findings to own institution	3.13 (1.08)	3.20 (1.04)	2.95 (1.16)
Help others apply research findings	2.89 (1.21)	2.64 (1.17)	3.45 (1.10)
Other staff from your org involved in PBRN (#)	3.18 (4.72)	3.00 (4.92)	3.59 (4.31)
Frequency working on PBRN activities[2]	3.27 (1.10)	3.02 (0.99)	3.86 (1.13)
Frequency working with PBRN Nat'l Center[2]	2.68 (1.34)	2.33 (1.03)	3.50 (1.63)
Organization's role in PBRN activities[3]			
Convening participating organizations	2.97 (1.41)	2.57 (1.32)	3.86 (1.25)
Identifying research topics/ideas	3.29 (1.07)	3.02 (0.98)	3.90 (1.04)
Designing/planning studies	2.76 (1.31)	2.35 (1.12)	3.68 (1.29)
Securing research funding	2.77 (1.48)	2.21 (1.21)	4.05 (1.25)
Implementing research studies	2.80 (1.42)	2.37 (1.22)	3.77 (1.41)

Participant Characteristics	All	Practitioners	Academics
Disseminating findings	3.12 (1.30)	2.75 (1.23)	3.95 (1.09)
Applying findings in own organization	3.03 (1.27)	3.06 (1.19)	2.91 (1.48)
Applying findings in other organizations	2.78 (1.31)	2.41 (1.19)	3.59 (1.22)
Orientation on practice-research continuum[4]	5.00 (1.69)	5.58 (1.33)	3.59 (1.68)
N	75	52	23

Source: Authors' analysis of survey data from participants in the first five public health PBRNS to become operational in the U.S., 2010

Table Notes:

[1] Five point ordinal scale: 1=Low, 5=High

[2] Five point ordinal scale: 1=Never, 5=One or more times per week

[3] Five point ordinal scale: 1=No role, 5=Leading role

[4] Seven point ordinal scale: 1=Exclusively research-oriented, 7=Exclusively practice-oriented

Table 3

Participant Experiences and Perceived Benefits with Public Health PBRNs

Variable	All Mean (S.D.)	Practitioners Mean (S.D.)	Academics Mean (S.D.)
Perceived benefits of PBRN participation[1]			
Learning more about PBRNs	3.19 (0.70)	3.12 (0.73)	3.36 (0.66)
Learning more about PHSSR	3.70 (0.73)	3.60 (0.74)	3.90 (0.70)
Learning about funding opportunities	3.77 (0.89)	3.64 (0.92)	4.05 (0.79)
Identifying ways to improve PH practice	4.00 (1.04)	4.28 (0.76)	3.32 (1.29)
Raising public/policy awareness of PH	4.10 (0.85)	3.96 (0.86)	4.36 (0.79)
Demonstrating accountability in PH	3.97 (0.83)	3.96 (0.78)	3.95 (0.95)
Networking with peers/colleagues	3.44 (0.78)	3.36 (0.80)	3.64 (0.73)
Competing for research funding	3.63 (1.06)	3.50 (1.09)	3.95 (0.95)
Competing for practice funding	3.88 (0.99)	3.94 (0.87)	3.73 (1.24)
Identifying innovations in PH practice	4.20 (0.79)	4.06 (0.81)	4.45 (0.67)
Motivating staff within organization	3.31 (1.18)	3.44 (1.11)	3.00 (1.31)
Raising stature/prestige of PH profession	3.74 (0.99)	3.72 (0.93)	3.77 (1.15)
Helping other organizations improve practice	3.90 (1.02)	3.62 (0.92)	4.50 (0.96)
Steering research to relevant topics	4.23 (0.77)	4.08 (0.75)	4.55 (0.74)
Alignment of your research interests with PBRN[2]	5.09 (1.32)	4.92 (1.48)	5.45 (0.74)
PBRN considers your research ideas[3]	3.78 (1.58)	3.86 (1.48)	3.55 (1.82)
PBRN benefits outweigh costs[4]	3.96 (0.86)	3.83 (0.90)	4.27 (0.70)
Likelihood of continuing PBRN participation[5]	6.09 (1.24)	5.88 (1.38)	6.59 (0.67)
Likelihood of participating in PBRN study[5]	5.79 (1.22)	5.67 (1.22)	6.14 (1.17)
N	75	52	23

Source: Authors' analysis of survey data from participants in the first five public health PBRNS to become operational in the U.S., 2010

Table notes:

[1] Five-point ordinal scale: 1=Extremely low, 5=Extremely high

[2] Seven-point ordinal scale: 1=Extremely low, 7=Extremely high

[3] Five-point ordinal scale: 1=Never, 5=Always

[4] Five-point ordinal scale: 1=Strongly disagree, 5=Strongly agree

[5] Seven-point ordinal scale: 1=Extremely unlikely, 7=Extremely likely

Table 4

Patterns of Interaction in Public Health PBRNs as Indicated by Network Analysis Measures

	Organization-Level Centrality		Network-Level Structure	
PBRN Network	**Degree Mean (S.D.)**	**Betweeness Mean (S.D.)**	**Density**	**Centrality**
Colorado	17.35 (9.10)	0.18 (0.23)	2.57	27.44
Kentucky	19.58 (7.14)	0.06 (0.11)	2.27	27.15
Massachusetts	36.22 (6.89)	0.08 (0.12)	3.21	36.67
North Carolina	45.19 (12.13)	0.02 (0.03)	2.40	36.27
Washington	49.66 (13.26)	0.01 (0.03)	2.19	34.40
All practice organizations	31.84 (16.16)	0.04 (0.08)	--	--
All academic institutions	41.37 (19.43)	0.13 (0.21)	--	--
All organizations	34.84 (17.56)	0.07 (0.14)	--	--

Source: Authors' analysis of survey data from participants in the first five public health PBRNS to become operational in the U.S., 2010

Table 5

Selected Research Topics in Public Health PBRN Studies, 2009-11

Network	Topic/Title
I. Economic Shocks, Financing, and Resource Allocation in Public Health	
CO	Public Health Roles in Local Resource Allocation Decisions for Safe Routes to Schools Programming
CT	Effects of Financial Constraints and Regionalization Incentives on Local Public Health Delivery
FL	Local Spending Variation in Essential Public Health Service Domains
MN	Effects of Local Tax Levies on Local Public Health Services
NC	Effects of Medicaid MCH Payment Changes on Local Public Health Practices and Outcomes
NC	Comparative Effectiveness Research Tools for Examining Public Health Services and Outcomes
WA	Effects of Economic Shocks and Evidence-Based Decision-Making in Public Health
WA	Public Health Activities and Services Tracking Study
WI	Forecasting the Impact of the Economic Recession on Public Health Financing
II. Quality Measurement and Improvement in Public Health	
CO	Effects of Community Partnerships on Adoption of Evidence-Based Prevention
CT	Measuring Quality in Local Public Health Emergency Preparedness During the H1N1 Outbreak
FL	Local Public Health Responses to the County Health Rankings
KY	Effects of a Public Health QI Intervention on Evidence-Based Diabetes Prevention
KY	Local Variation in H1N1 Communication and Response in Kentucky
MA	Local Variation in Food Safety and Infectious Disease Control Practices
MN	Measuring the QI Continuum and Correlates in Public Health Settings
MN	A Taxonomy of QI Methods, Techniques and Results in Public Health
MO	Effects of Public Health Accreditation on Quality Improvement Philosophy
NC	Local Variation in H1N1 Response in North Carolina
NY	Effects of Integrated HIV/AIDS and STD Service Delivery in New York: A Natural Experiment
OH	Local Variation in Prevention, Investigation, and Intervention Practices for Foodborne Illness in Ohio
OH	Variation in Local Enforcement of a State Clean Indoor Air Law
OH	Analyzing Concordance between Position Descriptions and Practice Standards for Public Health Nurses
OH	Direct Observation Methods in Local Public Health Settings: Foodborne Outbreak Practices in Ohio
WI	Measuring the Quality of Community Health Improvement Planning and Implementation
WI	Utility of Electronic Information Systems for Studying Local Public Health Practices and Outcomes
III. Regionalization, Consolidation, and Multi-Jurisdictional Approaches to Public Health Delivery	
CO	Public Health Law and Regionalization
CT	Effects of Financial Constraints and Regionalization Incentives on Local Public Health Delivery
GA	Feasibility and Effectiveness of Multi-Jurisdictional QI Collaboratives for Small and Rural Public Health Settings
GA	Comparative Effectiveness of State vs. Regional Approaches to QI in Public Health
MA	Effects of State Incentives on Development and Implementation of Regional Public Health Delivery Models
NE	Quality Improvement Strategies and Regional Public Health Structures
NE	Regional Public Health Structures and Readiness for Accreditation and QI
WI	Local Variation in Multi-Jurisdictional Models of Public Health Shared Service Delivery
IV. Equity, Health Disparities and Public Health Delivery	
CT	Utilization and Effectiveness of a Health Equity Index in Mobilizing Local Public Health Action

Network	Topic/Title
KY	Effects of Cultural Competency Training on Local Health Departments: A Randomized Trial
MN	Variation in Local Public Health Actions to Address Health Inequities
WA	Evaluation of a Quality Improvement Project to Improve Workforce Diversity
WA	Local Health Department Workforce Reductions: Implications for Diversity and Health Disparities

Source: Authors' analysis of PBRN research proposals and progress reports