Developing a Network of Community Health Centers With a Common Electronic Health Record: Description of the Safety Net West Practice-based Research Network (SNW-PBRN)

Jennifer E. DeVoe, MD, DPhil, Rachel Gold, PhD, MPH, Mark Spofford, PhD, Susan Chauvie, MPA-HA, RN, John Muench, MD, MPH, Ann Turner, MD, Sonja Likumahuwa, MID, MPH, and Christine Nelson, PhD, RN

In 2001, community health center (CHC) leaders in Oregon established an organization to facilitate the integration of health information technology, including a shared electronic health record (EHR), into safety net clinics. The Oregon Community Health Information Network (shortened to OCHIN as other states joined) became a CHC information technology hub, supporting a network-wide EHR with one master patient index, now linked across >40 safety net organizations serving >900,000 patients with nearly 800,000 distinct CHC visits. Recognizing the potential of OCHIN′s multiclinic network and comprehensive EHR database for conducting safety net-based research, OCHIN leaders and local researchers formed the Safety Net West practice-based research network (PBRN). The Safety Net West "community-based laboratory," based at OCHIN, is positioned to become an important resource for many studies including: evaluation of the real-time impact of health care reform on uninsured populations; development of new models of primary care delivery; dissemination and translation of interventions from other EHR-based systems (e.g., Kaiser Permanente) into the community health setting; and analyses of factors influencing disparities in health and health care access. We describe the founding of Safety Net West, its infrastructure development, current projects, and the future goals of this community-based PBRN with a common EHR. (J Am Board Fam Med 2011;24:597–604.)

Keywords: Community Health Networks, Electronic Medical Records, Practice-based Research, Primary Health Care

Ten years ago, safety net clinic leaders in Oregon established a community-based organization to implement and support a common electronic health record (EHR) system. This coalition, called the Oregon Community Health Information Network and shortened to OCHIN, Inc., as other states joined, became an information technology hub to a large network of community health centers (CHCs). Recognizing the potential for conducting safety net research using OCHIN′s multiclinic network and EHR database, OCHIN staff, clinicians, and local researchers formed the Safety Net West

Practice Based Research Network (PBRN). With OCHIN providing the PBRN's administrative home, Safety Net West began developing a research agenda that addressed the interests of its safety net partners and capitalized on OCHIN's data resources. Safety Net West is unique because of its EHR data linked across safety net clinics and also because it is housed in a nonprofit community organization rather than an academic research center. We describe the founding of Safety Net West, its infrastructure development, current projects, and future goals.

The Founding of Safety Net West

OCHIN: A Health Center–Controlled Network of Community Health Centers

In 2001, OCHIN was created to facilitate the adoption of state-of-the-art electronic health records in safety net clinics and thus to improve the quality of care delivered in those clinics. OCHIN received support from the US Department of Health and Human Services' Health Resources and Services Administration (HRSA), and is both an HRSA-designated Health Center–Controlled Network and a federally designated Organized Health Care Arrangement. As a nonprofit corporation, OCHIN is governed by a volunteer board of directors, most of whom represent its member clinics; the rest are community health leaders. OCHIN's mission is to pioneer the use of health information technology (HIT) in caring for the medically underserved.

With the aid of HRSA grants and local foundations, OCHIN's coalition of Oregon-based CHCs and other safety net organizations pooled their purchasing power to install a centrally hosted EHR. This collective group believed that providing quality HIT to the most vulnerable and underserved patients was not only the right thing to do but was also financially prudent. For these reasons, they chose to partner with Epic©, a leader in HIT. The OCHIN Epic© EHR is linked across all member clinic sites—a fully integrated electronic health information exchange system in which each patient has a single medical record. OCHIN's customized EHR facilitates input and use of patient information at the point of care; interfaces enable the EHR to access external information (e.g., lab reports, imaging results, insurance eligibility). It is also possible to make reliable linkages between OCHIN EHR and state Medicaid data.[1,2] Decision support tools facilitate data aggregation, enabling clinicians to treat patients at the individual, panel, and clinic level. OCHIN's dataset also provides researchers with population-level information on primary care delivery in vulnerable safety net clinic populations, including people who are uninsured. Today, OCHIN includes more than 40 member organizations serving more than 900,000 unique patients with nearly 800,000 distinct visits since 2001 (Table 1). To our knowledge, this is one of the richest community health center–based EHR data sources in the country.

Safety Net West: A Practice-based Research Network of Community Health Centers

The combination of factors—a multistate network of safety net clinics, an EHR with rich data linked across the network, and support from OCHIN's leadership—provided momentum for developing capacity to improve care quality in the safety net by optimizing practice through research. To that end,

Table 1. OCHIN Health Center and Patient Demographics, December 2010

|	
No. of health centers	40
No. of clinics	132
No. of providers	1934
Overall No. of patients total	881,259
Annual No. of patients total	391,267
Ethnicity (%)	
Hispanic	30.5
Non-Hispanic	69.5
Race (%)	
African American	4.5
Asian	2.7
Other race, or unknown	7.8
White	75.0
Sex (%)	
Female	58.7
Male	41.3
Age (%)	
< 18 years	33.7
> 18 years	62.3
Insurance status (%)	
Medicaid	45
Uninsured	31
Medicare	8
Commercial	11
Homeless (%)	5.4
Migrant/seasonal (%)	4.0

Data source: OCHIN electronic health record.
OCHIN, Oregon Community Health Information Network.

OCHIN began collaborating with two local academic researcher centers: the Center for Health Research (CHR) at Kaiser Permanente Northwest, and Oregon Health and Science University (OHSU). In 2005 to 2006, CHR and OCHIN developed a "Guide to Conducting Research in the OCHIN Practice Management Data."[3] Next, two OCHIN member organizations partnered with CHR investigators to develop an obesity intervention for Latino children. These first projects illustrated the feasibility and potential benefits of OCHIN-based research and piloted the development of the contractual agreements needed to facilitate such research.

OCHIN's board, led by Dr. John Saultz, chair of OHSU's Department of Family Medicine (DFM), supported the establishment of the Safety Net West PBRN. Two of the four OHSU health centers are OCHIN members that were among the first to adopt and implement the OCHIN electronic health record. The Community Engagement program of the Oregon Clinical and Translational Research Institute (OCTRI), an OHSU-CHR partnership funded by a Clinical and Translational Science Award, supported a part-time Safety Net West Director from 2007 to 2010. The PBRN, registered with the Agency for Health care Research and Quality in 2007, was housed at OCHIN to maximize its independence and focus on community-based research. Its mission is to encourage research with the potential to directly benefit safety net patients, to develop and improve OCHIN's data resources for research purposes, to partner with interested researchers, and to translate research findings into prac-

Figure 1. Safety Net West and Oregon Community Health Information Network (OCHIN) Partnership Structure.
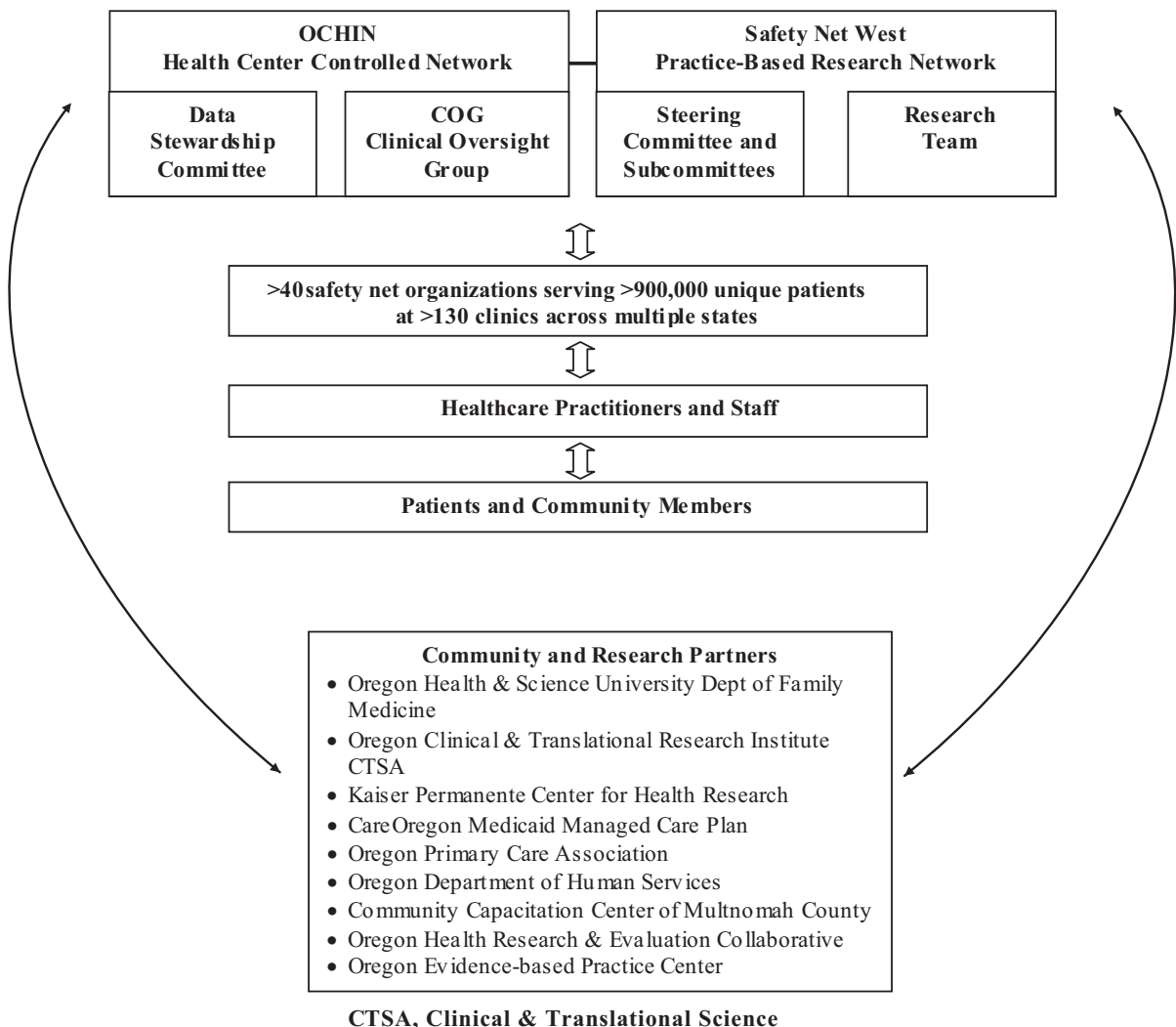
tice. Safety Net West includes members from all OCHIN-affiliated clinics; coordinates with OCHIN′s Clinical Oversight Group, a workgroup of OCHIN medical directors and clinicians that directs the content and structure of OCHIN′s EHR, and OCHIN′s Data Stewardship Committee, charged with ensuring the appropriate use of OCHIN data.

Facilitators and Barriers
Several factors facilitated the successful creation of the Safety Net West PBRN. In addition to the synergy between strong leadership, the unique patient population, and the linked EHR, OCHIN leaders had a vision that extended beyond supporting the delivery of clinical care in safety net settings. There was interest in developing resources to improve practice and to influence policy. As a health center–controlled network, the organization also developed early processes that enabled representation and voice from all members and encouraged collaborative decision making.

Similar to barriers encountered by most PBRNs, while there was strong expressed interest in research among OCHIN members, they generally felt limited in time, money, and expertise. Most affiliated clinics had little infrastructure to support research activities and already felt stretched to meet the many competing demands of caring for an underserved patient population. Some expressed concern that research might interfere with their own internal quality improvement plans. Most were more enthusiastic with studies that focused only on available EHR data and didn't require changes in clinic workflows or processes or add to their staff workload. The use of OCHIN's unique and unprecedented data resources for these "data-only" studies required the development of policies to address who owns the data, what are proper uses of the data, and how best to secure and share the data.

Infrastructure Development
Recognizing the need for research infrastructure, OCHIN, CHR, and OHSU collaborated to obtain two development grants made available through the 2009 American Recovery and Reinvestment Act. The first, an RC4 from the National Library of Medicine, "*Collaborative Research Efforts Aimed at Translating Evidence and building Community Capacity*," is designed to (1) strengthen the capacity of the Safety Net West "community PBRN

laboratory," (2) engage OCHIN′s members in formulating and conducting research,[4,5] and (3) facilitate translation of research results to improve the health of disadvantaged populations. The second grant, "*Building Research Infrastructure to Develop and Generate Comparative Effectiveness Studies*," made Safety Net West a research node in HRSA's national Community Health Applied Research Network (CHARN). It was designed to advance Safety Net West's ability to conduct comparative effectiveness research (CER). These projects will further develop Safety Net West's technical and personnel infrastructure.

Building Technical Infrastructure
In 2009, Safety Net West members collaborated on a pilot project to use OCHIN′s data in population-based research[6] and to validate linkages between OCHIN′s care utilization data and Medicaid claims.[1,2] Concurrent technical infrastructure developments aim to validate the quality of EHR data through comparisons with manual chart review, and to ensure that valid aggregated data are easily accessible for researchers in de-identified formats. In addition, bidirectional data sharing capacity (e.g., pharmacy and immunization data) and analysis of EHR free text are being developed.

Building Personnel Infrastructure
The research team at Safety Net West includes an executive director, operations director, project manager, research coordinator, information architect, and two research analysts. Team members from OCHIN and OHSU are paired with the goal of fostering collaboration. The team coordinates and supports the Safety Net West steering committee, which works to support a transfer of research expertise between academic researchers, OCHIN staff, and CHC partners. Through this partnership, the Safety Net West team has gained knowledge about federal research compliance, contracting, and business practices; academic researchers have learned about OCHIN′s data and the CHC practice environment, communities, and patient populations; and CHC partners have learned about framing research questions and testing hypotheses using their own data.

Portfolio of Research Projects
Table 2 summarizes all Safety Net West research projects since 2006, which include data-only stud-

Table 2. Recent and Current Oregon Community Health Information Network (OCHIN) and Safety Net West Research Projects

Title	Description	Type
Recent Projects		
Developing Safety Net Clinic Electronic Data for Use in Translational Health Services and Health Policy Research[1,2]	Determined that OCHIN's EHR data can be linked with Oregon's Medicaid claims data; assessed the extent to which OCHIN diabetes patients with Medicaid utilized services outside the OCHIN network, and the extent to which OCHIN data truly represented primary care utilization.	Data only
Insurance Continuity and Receipt of Diabetes Preventive Care In a Network of Federally-Qualified Health Centers[6]	Assessed how insurance continuity impacted utilization of diabetes preventive care services among OCHIN's adult Medicaid recipients.	Data only
Asthma Care Quality[20]	Developed, validated, applied, and evaluated a method for routine and comprehensive measurement of outpatient asthma care quality, using technology for extracting care quality data from both coded data and free-text clinical notes in the EHR.	Text analysis
PASS-2-OCHIN	Used the OCHIN EHR to conduct surveillance for incident cases of asthma.	Data only
Current projects		
Obesity Care Quality Term: 9/1/09 - 3/31/12 Funding Agency: AHRQ	Evaluates the generalizability of the Asthma Care Quality project methods for obesity.	Text analysis
Transforming Care Quality Term: 9/1/09 - 8/31/11 Funding Agency: HRSA	Expands network-wide quality improvement infrastructure by developing decision support tools to enable clinics to select appropriate workflow interventions to improve care for patients with diabetes.	CER
Using Health Information Exchange Networks for Dissemination of Effective Health Care Materials Term: 7/1/10 - 9/25/11 Funding Agency: AHRQ	Pilots the dissemination of provider and patient guides developed by the Effective Health Care Program within community health centers.	Translational
How Do Changes in Families' Health Insurance Affect Children's Healthcare? (FAMILY) Term: 9/1/10 - 4/30/14 Funding Agency: AHRQ	Assesses how children are affected when their parents gain or lose health insurance coverage, using mixed-methods: Medicaid/OCHIN data analysis, qualitative interviews with families, and datafrom the Medical Expenditure Panel Survey.	Data only
Dissemination of Cardiovascular Disease Risk Factor Treatment Among Diabetic Patients in FQHCs (ALL) Term: 9/7/10 - 5/31/15 Funding Agency: NIH/NHLBI	Translates an EHR-based intervention, proven to prevent cardiovascular disease in adults with diabetes in an integrated care setting by promoting and tracking compliance with statin and ACE-inhibitors, to the safety net setting.	Translational
Enhancing Clinical Effectiveness Research with Natural Language Processing of Electronic Medical Record (CER-HUB) Term: 9/30/10 - 9/29/13 Funding Agency: AHRQ	Creates and evaluates an internet-based Comparative Effectiveness Research Hub, which will serve as a portal for CER researchers to develop applications that code clinical data of all types, allowing uniform processing of data from any EHR system.	CER, text analysis

Continued

Table 2. Continued

Title	Description	Type
Internet CBT for Depression: Comparing Pure, Guided, and Stepped Care (MoodHelper) Term: 9/1/10 - 9/30/15 Funding Agency: NIH/NIMH	Utilizes a blended-efficacy-effectiveness randomized controlled trial of high fidelity, Internet-delivered cognitive behavioral therapy (CBT) for depression.	CER
Community Health Applied Research Network(CHARN) Term: 9/1/10 - 8/31/2013 Funding Agency: HRSA	OCHIN is designated as one of four program centers in a national community health center network developed by HRSA to advance infrastructure for conducting CER in safety net settings.	CER infrastructure
Collaborative Research Efforts Aimed at Translating Evidence and Building Community Capacity (CREATE) Term: 9/30/10 - 9/29/13 Funding Agency: NIH/NLM	Strengthens research capacity by bringing together OCHIN clinicians, patients, community representatives, state policy makers and researchers to oversee, formulate, and conduct research designed to improve health outcomes in Safety Net West populations.	CER infrastructure

EHR, electronic health record; AHRQ, Agency for Healthcare Research and Quality; NIH/NHLBI, National Institutes of Health/National Heart, Lung and Blood Institute; ACE, angiotensin-converting enzyme; CER, comparative effectiveness research; NIH/NIMH, National Institutes of Health/National Institute of Mental Health; HRSA, Health Resources and Services Administration; NIH/NLM, National Institutes of Health/National Library of Medicine.

ies, translational research, text analysis, Comparative Effectiveness Research (CER), and research infrastructure development. Safety Net West emphasizes both "bottom-up" and "top-down" research ideas—studies conceived by OCHIN practitioners that are brought to researchers to develop, and ideas generated by academic researchers that are brought to practitioners for feedback and direction. One bottom-up study seeks to translate a quality improvement initiative from an integrated care setting into 12 OCHIN clinics; the idea came from an OCHIN clinician, funding acquisition was led by a CHR researcher, and the study is being implemented collaboratively. One top-down study is developing methods for evaluating asthma care using data extracted from free-text analysis of clinic notes in OCHIN′s EHR. This idea came from a CHR researcher and was embraced by Safety Net West as an innovative approach to using OCHIN′s data to improve care quality.

### Goals for Expanding Safety Net West's Infrastructure and Research Scope

The Safety Net West "community-based laboratory," based at OCHIN, is positioned to become an important resource for many studies including: evaluation of the real-time impact of health care reform on uninsured populations; development of new models of primary care delivery; dissemination and translation of interventions from other EHR-based systems (e.g., Kaiser Permanente) into the community health setting; and analyses of factors influencing disparities in health and health care access.

Governance and Operations

As Safety Net West matures, we will strategically develop its governance and build appropriate operations mechanisms. We will maintain the core steering committee and have established three subcommittees to support the steering committee's work, including (1) Data and Research Development (2); Communications and Community Engagement; and (3) Policies and Governance. These committees will oversee continued network development and undertake tasks related to: building policies for data use and sharing; developing capabilities for data extraction, quality improvement, linkages, and sharing; disseminating information and strengthening partnerships with community stakeholders; refining organizational infrastructure and relationships between PBRN members; and developing research priorities and projects. Through these processes, we hope to build a robust collection of secondary data that will be available to research

Figure 2. Synergy Between Practice Transformation and Research.
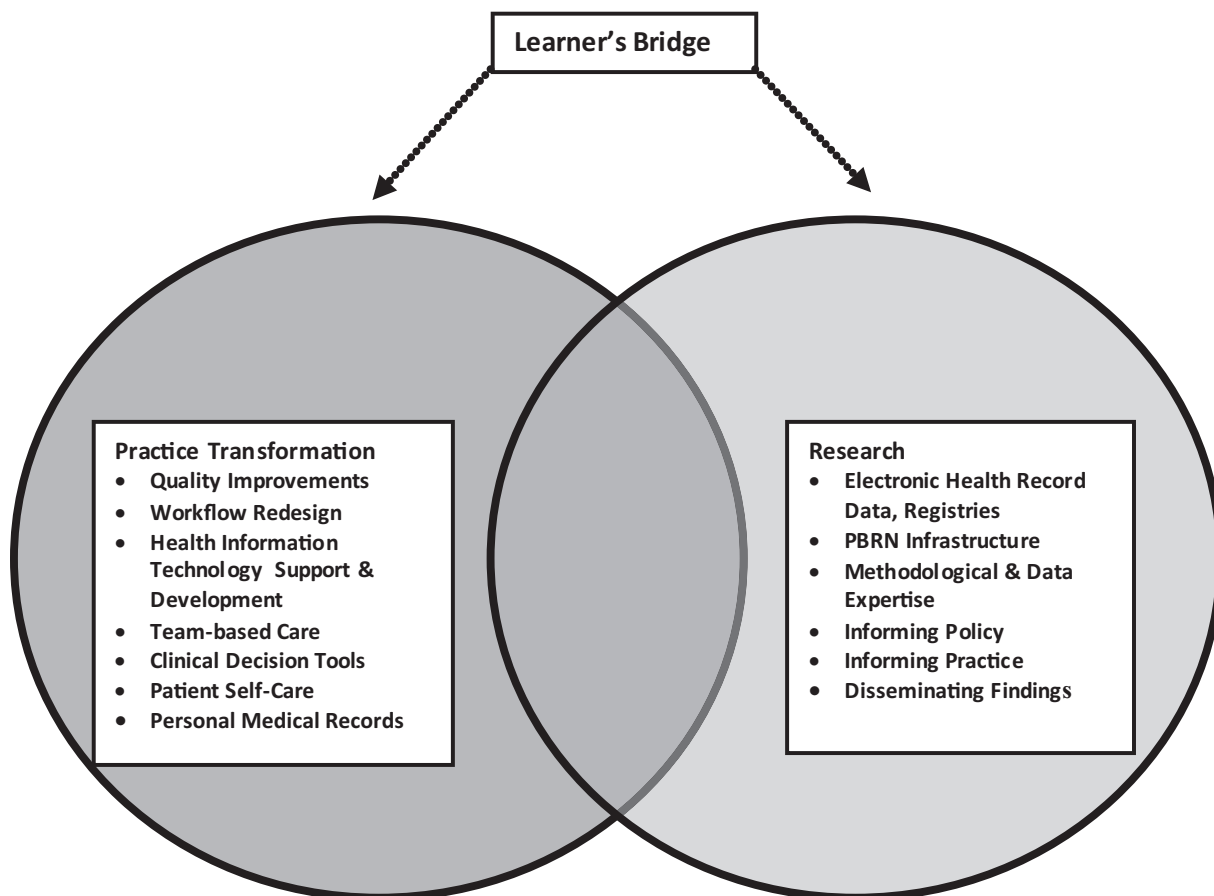
collaborators from across the country who have not previously had access to electronic health care services utilization data on underserved and uninsured populations.

Bridging Practice Transformation and Research Activities

Many Safety Net West member clinics are participating in cutting-edge practice transformations that go beyond demonstrating HIT's potential in facilitating primary care improvements. Partnering with OCHIN, researchers, and payers, many practices are organizing themselves as Patient-Centered Medical Homes.[7–12] We envision a synergy between practice transformation and research activities, strengthened by a "learner's bridge" that provides opportunities for community partners to learn the skills for implementing and evaluating practice interventions. The Safety Net West PBRN will thus serve as a laboratory where students, clinicians, and researchers can collaborate and learn from each other.

Although there is significant value in quality improvement activities, partnering with researchers who can evaluate and disseminate findings increases the likelihood that successful interventions can be replicated and sustained. This type of partnership ensures that meaningful activities will be documented and will contribute to the growing fund of knowledge about evidence-based, best practices in primary care.[13–19] Further, engaging learners in this partnership further strengthens the benefit for spread of innovation and sustainable future change.

Strengthening Partnerships, Sustainability

Network partnerships and sustainability must be built together. We believe that sustainability will be attainable as our PBRN matures, expands, and proves its worth to a diverse group of stakeholders. To that end, we aim to strengthen key partnerships between Safety Net West, OCHIN, community health centers, researchers, policymakers, and funders. It is these partnerships,

creative ideas, and data resources, plus a track record of contributions to practice transformation and ultimately, the improvement of our populations' health that will determine our success.

References

1. Gold R, DeVoe JE, McIntire P, et al. Comparing the effectiveness of continuous versus sporadic insurance coverage on receipt of diabetes services in a safety net clinic network. Fam Med 2011;43(Suppl 1).

2. DeVoe JE, Gold R, McIntire P, et al. Electronic health records vs. Medicaid claims: completeness of diabetes preventive care data in community health centers. Ann Fam Med 2011;9:351–8.

3. Gold R. The Guide to Conducting Research in the OCHIN Practice Management Data. Portland, OR: Kaiser Permanente Center for Health Research; 2007.

4. Williams RL, Shelley BM, Sussman AL, et al. The marriage of community-based participatory research and practice-based research networks: can it work? A Research Involving Outpatient Settings Network (RIOS Net) study. JABFM 2009;22:428–35.

5. Westfall JM, Fagnan LJ, Handley M SS, et al. Practice-based research is community engagement. JABFM 2009;22:423–7.

6. Gold R, DeVoe JE, Shah A, Chauvie S. Insurance continuity and receipt of diabetes preventive care in a network of Federally-Qualified Health Centers. Med Care 2009;47:431–9.

7. Rosenthal TC. The medical home: growing evidence to support a new approach to primary care. JABFM 2008;21:427–40.

8. Nutting PA, Miller WL, Crabtree BF, et al. Initial lessons from the first national demonstration project on practice transformation to a patient-centered medical home. Ann Fam Med 2009;7:254–60.

9. Reid RJ, Fishman PA, Yu O, et al. Patient-centered medical home demonstration: a prospective, quasi-experimental, before and after evaluation. Am J Manag Care 2009;15:e71–87.

10. Rittenhouse DR, Shortell SM. The patient-centered medical home: will it stand the test of health reform? JAMA 2009;301:2038–40.

11. Stange KC, Miller WL, Nutting PA, et al. Context for understanding the National Demonstration Project and the patient-centered medical home. Ann Fam Med 2010;8(Suppl 1):S2–8.

12. Stange KC, Nutting PA, Miller WL, et al. Defining and measuring the patient-centered medical home. J Gen Intern Med 2010;25:601–12.

13. Bohmer RM, Edmondson AC. Organizational learning in health care. Health Forum J 2001;44:32–5.

14. Institute of Medicine (IOM). The State of Quality Improvement and Implementation Research: Expert Views. Workshop Summary. Washington, DC: The National Academies Press; 2007.

15. Edmondson AC. Learning from failure in health care: frequent opportunities, pervasive barriers. Qual Saf Health Care 2004;13:3–9.

16. Glasgow RE, Vogt TM, Boles SM. Evaluating the public health impact of health promotion interventions: the RE-AIM Framework. Am J Public Health 1999;89:1322–7.

17. Berwick DM. Broadening the view of evidence-based medicine. Qual Saf Health Care 2005;14:315–6.

18. Davidoff F, Batalden P. Toward stronger evidence on quality improvement: draft publication guidelines: the beginning of a consensus project. Qual Saf Health Care 2005;14:319–25.

19. Baker GR. Strengthening the contribution of quality improvement research to evidence based health care. Qual Saf Health Care 2006;15:150–1.

20. Hazlehurst B, McBurnie M, Mularski R, et al. Automating quality measurement: a system for scalable, comprehensive, and routine care quality assessment. AMIA Annu Symp Proc 2009;229–233.