

Networks to Strengthen Health Systems for Chronic Disease Prevention

Cameron D. Willis, PhD, Barbara L. Riley, PhD, Carol P. Herbert, MD, and Allan Best, PhD

Interorganizational networks that harness the priorities, capacities, and skills of various agencies and individuals have emerged as useful approaches for strengthening preventive services in public health systems. We use examples from the Canadian Heart Health Initiative and Alberta's Primary Care Networks to illustrate characteristics of networks, describe the limitations of existing frameworks for assessing the performance of prevention-oriented networks, and propose a research agenda for guiding future efforts to improve the performance of these initiatives. Prevention-specific assessment strategies that capture relevant aspects of network performance need to be identified, and feedback mechanisms are needed that make better use of these data to drive change in network activities. (*Am J Public Health*. 2013;103:e39–e48. doi:10.2105/AJPH.2013.301249)

In 2030, it is anticipated that 69% of deaths worldwide will be attributable to noncommunicable diseases, most of which will be chronic.¹ Over time, the profile of these chronic conditions (e.g., cancer, diabetes, cardiovascular disease, and respiratory illness) has changed: cases are occurring at younger ages,² outcomes are being enhanced through new technologies,³ and persons with chronic diseases are living longer.⁴ Traditional sickness-based health systems primarily designed to respond to acute and communicable diseases are ill-equipped to deliver the complex, integrated, multisector, and sustained activities required to tackle chronic disease challenges.¹ Multilevel interorganizational networks play useful roles in addressing the multifaceted needs of chronic disease prevention. Here we use contemporary examples of chronic disease prevention networks to illustrate some of the challenges facing network efforts and sketch a preliminary research agenda for improving our understanding of how networks may be strengthened in chronic disease prevention efforts.

HEALTH SYSTEM STRENGTHENING AND CHRONIC DISEASE PREVENTION

The World Health Organization identifies 6 building blocks that form the foundations of

health systems: service delivery; health workforce; information; medical products, vaccines, and technologies; financing; and leadership and governance.⁵ In recent years, the organization's approach to health system strengthening has evolved from a focus on individual building blocks to a recognition of the importance of how these elements are related, defining health system strengthening as improving the

six health system building blocks and managing their interactions in ways that achieve more equitable and sustained improvements across health services and health outcomes.^{6(p4)}

People are pivotal to the development and orchestration of these interactions. Although many initiatives are considered to contribute to this effort, Chee et al. argue that interventions that truly strengthen health systems involve

comprehensive changes to policies and regulations, organization structures, and relationships across the health system building blocks that motivate changes in behavior, and/or allow more effective use of resources to improve multiple health services.^{7(p2)}

Chronic disease prevention, although supported in principle, has gained little traction in worldwide efforts to strengthen health systems.^{8,9} Multiple factors may be responsible for this, such as the dispersed and delayed benefits from disease prevention efforts; the

often unknown and unrecognized benefactors of prevention activities, especially population-wide efforts; the invisible nature of well-executed prevention initiatives; the broad involvement required from multiple organizations spanning the public and private sectors and civil society; and prevailing investment strategies that prioritize issues that “garner most attention and generate the most fear . . . regardless of how likely they are to occur or how many people they could impact.”^{10(p2)} Moreover, preventive efforts may interfere with macro-level political issues or shift resources in ways that threaten existing arrangements, causing many evidence-based preventive efforts to be “thwarted (easily) by powerful corporate or political interests.”^{10(p3)}

Remedying this situation is thought to require a range of initiatives, in addition to evidence-based prevention strategies, such as increasing global and national leadership, improving and sustaining resources for chronic disease prevention, implementing appropriate information gathering and surveillance, and increasing investment in high-functioning public health and primary care systems.⁸ Therefore, strengthening health systems to prevent chronic disease requires more than money¹¹: it requires new ways of working that (1) mobilize efforts across multiple disease groups, (2) commit to the long-term requirements of chronic disease prevention, and (3) explicitly focus on the value of relationships between different disciplines and organizations, including how they are affected by leadership, vision, trust, culture, and shared values.^{11–14} Creating the conditions whereby these new ways of working may be realized requires coordinated efforts across clinical, political, and academic domains that blend designated and distributed leadership, use feedback loops, recognize historical contexts, involve physicians as partners in change, and engage patients and their families.¹⁵

A ROLE FOR NETWORKS

Recently, many efforts to strengthen the capacity of health systems to prevent chronic diseases have worked through multiagency, multilevel networks. Such networks have emerged as important vehicles in the pursuit of more integrated care (both horizontally and vertically). As noted by Shortell et al., integration may be functional or focus on physicians or clinics, pursue common aims, and create shared accountability to a defined population.^{16,17} Although past efforts at integrating health services have faced difficulties,^{18,19} integration of care remains central to many chronic care and population management frameworks, including the integrated care for chronic conditions framework,²⁰ the chronic care model,²¹ and the expanded chronic care model.²² Networks are an important component of these frameworks and offer useful approaches for improving continuity of services and coordination between system components.^{20,23}

Networks have been defined in several ways. Brass et al. describe a network as “a set of nodes and the set of ties representing some relationship, or lack of relationship, between the nodes.”^{24(p795)} These nodes may represent individuals, groups, or larger organizations.²⁴ Provan et al. focus on whole interorganizational networks that are considered to be “three or more organizations connected in ways that facilitate achievement of a common goal.”^{25(p482)} These networks are often formally rather than spontaneously established, with relationships based on factors such as flows of resources, information, people, or ideas.¹²

Studies of networks have yielded important insights into how these organizing structures influence attitudes, the generation of innovations, the degree of cooperation among members, and access to power and resources.²⁴ Thorough reviews of networks and their effectiveness are provided by Brass et al.,²⁴ Provan et al.,²⁵ Borgatti et al.,²⁶ and Varda et al.,²⁷ who comprehensively describe contemporary knowledge of network research, including the relationships between network functions and network outcomes. In brief, networks are thought to have several advantages over isolated organizations, such as more

efficient use of resources (financial and other), greater opportunities for learning, and improved capacity to address complex problems.²⁸ Moreover, members of networks are thought to be more satisfied, less likely to experience conflict, and more productive than nonmembers.¹²

Despite the growth and support of networking approaches to the organization of public health systems, our knowledge of networks—particularly how they strengthen health systems and their ability to genuinely improve population health—remains limited.²⁹ Alongside investments in networks for preventing and treating chronic disease, we require a sustained program of research, structured around examples of contemporary network experiments, to identify key issues and challenges, develop improvement initiatives, and test these efforts through rigorous, action-oriented case studies.

In pursuit of this goal, we offer an early effort to shape a research agenda. We explored the experiences of 2 Canadian networks: Alberta's Primary Care Networks (PCNs) and the Canadian Heart Health Initiative (CHHI). Alberta's PCNs provide an example of a service delivery network (with a focus on prevention), and the CHHI provides an example of a comprehensive, multilevel public health network. We analyzed published data available on both networks and primarily focused on the inter-organizational network (interpersonal or inter-unit analyses of the same networks might yield different insights).

The process by which we identified these network examples and our analytical methods are detailed in Appendix A (available as a supplement to the online version of this article at <http://www.ajph.org>). Briefly, we reviewed retrieved documents with an organizing framework that combined elements from 2 articles published by leading experts in network formation and evaluation.^{25,30} We used the first of these frameworks to outline 3 features of the CHHI and PCN examples: network development, structure, and governance.²⁵ We used the second framework to address 2 questions: What types of outcomes have been associated with these networks at the community, network, and organization levels? What types of outcomes are beyond the scope of this framework but may be important for prevention-oriented networks?³⁰ Figure A (available as

a supplement to the online version of this article at <http://www.ajph.org>) describes the frameworks employed in this analysis.

Our analysis yielded key issues to consider when examining how prevention-oriented network performance may be improved and an agenda for future research to optimize networks for strengthening the capacity of health systems to prevent chronic disease. Table 1 outlines key similarities and differences between Alberta's PCNs and the CHHI.

NETWORK DEVELOPMENT

In 2003, Alberta Health and Wellness, the Alberta Medical Association, and Alberta's Regional Health Authorities (now Alberta Health Services, or AHS) established a tripartite master agreement to improve the delivery of provincial health services through the development of PCNs.³¹ This agreement provided a provincial-level network framework to help organize provider-led service delivery networks, fostering partnerships between practices, physicians, other health care provider groups, nongovernment organizations, and regional health authorities. In addition to eliminating duplication of services, this multilevel network structure facilitated direct benefits for constituent agents and organizations, such as improved cooperation between providers and the AHS, enhanced capacity to provide care without sacrificing patient contact, and financial incentives to provide services not traditionally funded.³¹

By contrast to the service delivery focus of the PCNs, the CHHI was a 20-year, pan-Canadian effort begun in 1986 to address the impact of premature cardiovascular disease through a comprehensive, intersector, multilevel public health and partnership model. The CHHI aimed to stimulate Canada's public health systems to “design, implement and evaluate a set of [heart health] interventions”^{32(p216)}; mobilize efforts across agencies, government levels, policy initiatives, and implementation efforts; and reduce the prevalence of cardiovascular disease risk factors at the population level.^{32–34} The CHHI was developed to demonstrate the efficacy of prevention programs and to strengthen local capacity for planning and implementing community-based health promotion activities that addressed population health needs.^{33,35}

TABLE 1—Key Features and Outcomes of Alberta Primary Care Networks and the Canadian Heart Health Initiative

Features and Outcomes	CHHI	PCNs
Features		
Governance	<p>Created through funding from federal, provincial, and nongovernment sources</p> <p>Not governed by a memorandum to cabinet</p> <p>Federal-provincial relationships managed through agreements</p> <p>High-level decision-making performed by a small group</p> <p>Leadership stability reinforced by pre-existing relationships between network leaders</p> <p>Local governance arrangements ensured relevance to communities</p>	<p>Broad oversight of primary care initiative through consensus committee (equal membership from AHW, AHS, and the AMA)</p> <p>Shared governance approach between physicians (who form a voluntary NPC) and AHS</p> <p>NPC enters into contracts with individual physicians and other health care providers</p> <p>Operational decisions and policy implementation managed by NPC (governed by an elected board of physicians)</p> <p>Physicians maintain control over decisions affecting clinical care</p> <p>AHS retains responsibility for programs and facilities</p> <p>In 2003, AHW, AMA, and AHS (then Regional Health Authorities) established tripartite master agreement</p>
Development	<p>Occurred over a 20-y period:</p> <p>Phase 1: policy development</p> <p>Phase 2: provincial heart health risk factor surveys</p> <p>Phase 3: demonstration projects</p> <p>Phase 4: evaluation</p> <p>Phase 5: dissemination</p> <p>Network ceased activities following nonrenewal of federal funding in 2006</p> <p>Network never fully completed dissemination phase</p>	<p>Promoted a partnership-based approach between frontline providers and regional authorities</p> <p>Aimed to eliminate duplication of services and integrate health services</p> <p>Envisioned physician benefits: enhanced cooperation with AHS, improved capacity to provide care, financial incentives to provide needed services, and improved linkage between physicians</p>
Outcomes		
Community	<p>Provincial-level interventions built organization capacity, and community-level programs strengthened community partnerships</p> <p>Supported 10 provincial and 311 community demonstration projects</p> <p>Provincial health service providers (80%) believed CHHI demonstration projects made valuable contributions</p> <p>Sustainability through innovative resource usage: e.g., supporting ongoing full-time positions following project completion</p>	<p>Widespread improvement in organization of physician clinics</p> <p>Greater access to after-hours and weekend care</p> <p>Proportion of patients reporting themselves satisfied or very satisfied with primary care higher in PCNs than non-PCNs</p>
Organization	<p>Focus on improving organization capacity for implementing heart health programs</p> <p>Key improvements noted in organization knowledge use, skill development, productive partnerships, resource acquisition, infrastructure, leadership, and instilling a priority for CHHI activities</p> <p>Difficult to determine extent to which CHHI was responsible for change</p>	<p>Increase in number of Albertans with access to primary care</p> <p>Greater physician capacity to enroll new patients</p> <p>Improved delivery of comprehensive chronic disease management programs</p> <p>Reduction in emergency department admissions</p> <p>Improved patient monitoring and tracking</p> <p>Access to new resource streams</p> <p>Improved working conditions for physicians, increased physician satisfaction, and greater retention in primary care services</p>

Continued

TABLE 1—Continued

Network		
Dual promotion of good research and good interventions	Greater integration between health care providers	
Strengthened relationships within local CHHI networks	Improved patient transitions from hospital to home	
Network endurance ¹⁹	Increased satisfaction with timeliness of information	
Interaction between provincial and regional leaders led to stronger commitment to coordinate health promotion strategies, enhanced funding for health promotion activities, and a centralized resource support system	Improved delivery of health promotion education, greater provision of prenatal care, and enhanced provision of screening tests	
Local projects were affected by lack of resources and competing disease priorities, lack of coordinated leadership, competing political priorities, poor cohesion in public health systems, staffing issues, variable partnership development, and change in government	High degree of loyalty to PCN structure	

Note. AHS = Alberta Health Services; AMA = Alberta Medical Association; AHW = Alberta Health and Wellness; CCHI = Canadian Healthy Heart Initiative; CVD = cardiovascular disease; NPC = not-for-profit corporation; PCN = Primary Care Network. Alberta's PCNs are service delivery networks, and CHHI was a public health network.

NETWORK STRUCTURE

PCN development policy identified disease and injury prevention as essential activities of these service delivery networks. The specific aims of PCNs are listed in Figure B (available as a supplement to the online version of this article at <http://www.ajph.org>).³⁶ Each local network develops a tailored structure that supports the provision of the full spectrum of services (see the box on the next page), either through direct provision or through linkages with other organizations.³⁶ Service provision requires explicit, multilevel coordination between each PCN and the AHS, leading to broad engagement of a range of providers, including nurses, dietitians, pharmacists, and allied health care practitioners. This tailored approach to PCN establishment has allowed PCNs to develop different operational structures: for example, PCNs may colocate multiple physicians and other care professionals in 1 setting or operate virtual networks of providers distributed across multiple organizations. The diverse structure and size of PCNs gave rise to a mixed-funding approach that reimburses physicians through traditional fee-for-service mechanisms, plus a capitation model that supports network-specific activities through an annual Can\$50 payment per enrolled patient.³⁷ Networks secure access to this funding through approval of a formal business plan and adherence to agreed-upon performance targets. An example of how PCNs are delivering services for patients with diabetes is outlined in the top box on page e44.

The CHHI was a national initiative developed through a federal–provincial cofunding arrangement that aimed to support the establishment of intersector coalitions to promote heart health.³⁴ As with the PCNs, funding built local capacity, which the CHHI used for carrying out a spectrum of preventive activities, including research and program implementation. At the provincial level, interventions primarily focused on supporting organization capacity and developing policy; at the community level, programs centered on strengthening community partnerships, implementing programs, and promoting individual knowledge and behavior change.³³ However, funding for the CHHI was provided on a 5-year

cycle, creating uncertainty about the continuity and sustainability of partnerships. An overview of the demonstration phase of the CHHI is provided in the bottom box on page e44.

NETWORK GOVERNANCE

High-level PCN governance occurs through a participant governance model comprising equal representation from Alberta Health and Wellness, the AHS, and the Alberta Medical Association.^{38,39} Partnerships between PCNs and the AHS take the form of shared governance between a not-for-profit corporation of physicians and the AHS.^{40,41} This structure allows these corporations to contract individual physicians and other health care providers in ways that ensure clarity of provider responsibilities and that afford a level of insulation from the activities of others involved in the PCN. These clear governance approaches appear to be effective in preserving physician control over decisions that affect the clinical care of patients, while allowing the AHS to retain responsibility for its own programs and facilities. Although PCN performance is monitored through regular reporting of financial data, scant reporting on patient outcomes is provided.⁴¹

Local autonomy was similarly seen as an important characteristic of CHHI governance approaches, where a high degree of flexibility in decision-making at the provincial level was fostered through a series of individual agreements between federal sources and provincial representatives.³² This local decision-making facilitated implementation and dissemination strategies that were tailored to the situational experience of local teams.⁴² Despite this, role divisions between CHHI member agencies resulted in power imbalances, leading to turf wars between nongovernment organizations and federal funders for which appropriate internal resolution mechanisms were never fully implemented.^{43–45} The CHHI, although funded in part through federal government sources, was not governed by a memorandum to cabinet (briefing documents submitted by ministers seeking Cabinet decisions on proposals) and therefore operated outside the usual federal–provincial–territorial meeting structure, limiting formal accountability channels for sanction or scrutiny.⁴³ In addition, the

SERVICES PROVIDED

Services provided through Alberta Primary Care

Networks

Basic ambulatory care (including follow-up)
 Care of complex problems (including follow-up)
 Psychological counseling
 Screening and chronic disease prevention
 Family planning and pregnancy counseling
 Well-child care
 Obstetrical care
 Palliative care
 Geriatric care
 Care of chronically ill patients
 Minor surgery
 Minor emergency care
 Primary in-patient care (including hospitals and long-term care institutions)
 Rehabilitative care
 Information management
 Population health

Services provided through linkages between primary care and other areas

24/7 access to primary care services,
 Access to laboratory and diagnostic imaging, and
 Coordination of:

- Home care
- Emergency room services
- Long-term care
- Secondary care

small group of individuals responsible for high-level CHHI leadership (and the central role played by a single figure) failed to evolve to a more collaborative leadership model over time. Together, these factors robbed the CHHI of resilience to respond to major internal and external changes, ultimately contributing to network dissolution in 2006.^{32,43}

NETWORK OUTCOMES

Network outcomes are described by Provan and Milward on 3 levels: community, network, and organization, which is consistent with the multistakeholder nature of the CHHI and the PCNs.³⁰ These categories and their outcomes often overlap in practice, and this outcome classification approach has both advantages and limitations for assessing prevention-oriented networks.

Community Level

Community outcomes may be changes in the incidence of a problem, cost to the community, aggregate indicators of individual well-being, or public perceptions that a problem is being solved.³⁰ To date, no one has assessed how Alberta's PCNs have affected community health status, that is, its success or failure in modifying the incidence of chronic disease risk factors. The challenges in assessing these outcomes (e.g., the requisite lead time to detect significant changes) have led PCNs to develop alternative measures of community impact, such as assessments of clinic organization, patient access to care (including after-hours services), use of screening services, and coordination–integration of PCNs with external stakeholders.⁴⁶ Early evaluations of the PCN approach have demonstrated important community benefits, including an increase in the number of Albertans who have access to a primary care physician.⁴¹ Moreover, patient satisfaction surveys showed that a slightly higher proportion of patients enrolled in PCNs than others were satisfied or very satisfied with their primary care (80% vs 76%); however, no measure of statistical significance was provided.⁴¹

In population-wide prevention networks such as the CHHI, assessing community outcomes presents additional challenges. The CHHI's long-term goals of prevention (e.g., changes in national population health profiles) were supplemented with short-term health system goals, which, although important, are not necessarily captured by Provan et al.'s classification structure.³⁰ These system targets included improved integration of heart health into the planning and activities of governments, communities, volunteer agencies, professional groups, and private organizations.³³ Evaluative work by Robinson et al. suggests that up to 80% of provincial health service providers believed that the CHHI demonstration projects made valuable contributions to the integration of chronic disease prevention strategies, connected diverse stakeholders, and created multilevel partnerships (e.g., between provincial nongovernment organizations, professional associations, government departments, public health organizations, social services, and sports groups).⁴⁴

No formal network analysis of the relationship strength between these various agencies was reported.

Network Level

Provan and Milward consider network-level outcomes to encompass network survival, growth in network members, reduction of unnecessary duplication, relationship strength (multiplexity), member commitment, and integration–coordination of activities.³⁰ Evaluations of the PCNs suggest that this model is meeting many of these targets and is associated with greater integration between providers, including licensed practical nurses, registered nurses, home care workers, hospitals, community mental health staff, public health services, and physician specialists.⁴¹ As a result, patient transitions between services are thought to be improved, with more than 80% of physicians rating patient transitions from hospital to home as smooth.⁴⁶ Greater satisfaction with service arrangements has bolstered member loyalty to the PCN approach, with only 6% of physicians indicating a desire to leave their PCN at some point in the future.⁴¹

Because they do not have the service delivery orientation of the PCNs, comprehensive prevention networks such as the CHHI appear to require different measures of network outcomes. Integration and coordination of services are replaced to a large degree by integration and coordination across sectors. Through the development of local network solutions, CHHI collaborations were built across sectors (research, policy, and practice; health and other fields) in ways that facilitated informative research and tailoring of results to local contexts. Relationships within local CHHI networks were reported as strong and highly valued by network members, evidenced by the 20-year life of the CHHI.³⁴

Organization Level

Organization or participant outcomes relate to the benefits or harms to agencies that are members of a network, such as agency survival, enhanced agency legitimacy, resource acquisition, and service costs.^{30,36} Both the CHHI and PCN examples involve a range of semiautonomous organizations (e.g., federal and provincial health agencies, provider

IMPACT OF ALBERTA'S PRIMARY CARE NETWORKS ON PATIENTS WITH DIABETES

Of the 18 Primary Care Networks (PCNs) originally developed in Alberta, 17 explicitly identified care for patients with diabetes as a priority area. In their examination of PCNs, Manns et al. explore the impact of PCN enrolment on key process and outcome variables for patients with incident and prevalent diabetes. PCNs in Alberta demonstrate considerable flexibility in how they deliver services and how network funding is used for this patient group.

PCNs include Core Providers (often general or family medicine practitioners) responsible for "maintaining the ongoing relationship with a patient, for providing the range of Primary Care Network primary care services, and dedicating the majority of their work time to the Primary Care Network."^{36(p44)} Core Providers are supported by Associate Providers who agree to supply one or more of the required services.

While most PCNs use funds raised through the per-capita patient payment structure for supporting multi-disciplinary teams (e.g., practice nurses, allied health staff), other initiatives may be supported. For diabetes care, the majority of PCNs use per-capita PCN funding to provide enhanced diabetes services, including patient education and case-management, or as noted, a multidisciplinary team.

Key to these operations is the improved coordination between providers and improved access to care. Using administrative data from Alberta Health and Wellness, the authors compare differences in process and outcome between a cohort of patients with diabetes receiving care through a PCN and a cohort of patients not receiving care through a PCN.

Following a propensity score matching process, the authors describe small but significant advantages of PCN care compared to standard practice. For patients with prevalent diabetes, treatment in a PCN setting was found to be associated with a 19.4% relative reduction in admissions to hospital emergency departments, improved glycemic control, and greater application of guideline recommended laboratory and retinal screening.

While the authors suggest that a true randomized trial is required to determine the impact of PCNs on patient outcomes, results from this study are encouraging; the PCN approach may be an effective means for better coordinating and improving care for prevalent cases of diabetes.

Source: Manns et al.⁵⁶

organizations and practices, nongovernment organizations, regional health authorities), and organization outcomes are difficult to differentiate from network and community outcomes. This is consistent with the view of Provan and Milward that such levels often overlap.³⁰

PCN evaluations suggest that many positive outcomes are being realized for member organizations (primarily physician-led practices), including improved patient outcomes,³⁷

physician capacity to enroll new patients,⁴⁶ confidence in the ability of physicians to access new resource streams as well as deliver evidence-based drug therapies,⁴¹ and delivery of comprehensive chronic disease management programs.⁴⁷ PCN involvement is also thought to have improved working conditions for participating physicians, with more than 97% now colocated within multidisciplinary teams, which has increased physician satisfaction and

improved retention in primary care services.^{41,46} Evidence is growing that PCNs are improving the appropriateness of service use beyond member agencies; one example is a reduction in emergency department visits.^{41,48} Despite these gains, comparisons between the outcomes of PCN members and nonmembers are limited, and the level of legitimacy PCN participation brings to member organizations remains unexplored.

OVERVIEW OF CANADIAN HEALTHY HEART INITIATIVE DEMONSTRATION PROJECTS

The demonstration phase of the Canadian Healthy Heart Initiative (CHHI) was a 7-year undertaking from 1989 to 1995 involving all 10 provinces, and constituted the "back-bone" of the CHHI. The overall goals of demonstration projects were to "plan, implement and evaluate projects to build the capacity for heart health; and to carry out supporting implementation research." Based on findings from the national heart surveys, each province designed and implemented a set of initiatives tailored to local needs. Consequently, provincial demonstration programs were diverse in terms of their management, the conceptual model used to frame activities, and the processes by which demonstration projects were selected. Approximately Can\$36 million was allocated to the CHHI demonstration phase, providing support for 10 provincial programs, 35 community level initiatives, and 311 individual demonstration projects.

Projects varied widely in activity and setting. Primary strategies for addressing risk factors associated with CVD included public education (e.g., information dissemination strategies such as newspapers, cable television advertisements, school newspapers, or project newsletters); community mobilization (e.g., community granting schemes, workplace wellness programs); developing healthy public policy (e.g., developing school policies, drafting a clean air bylaw to municipal council, endorsing healthy food choices in restaurants); and strengthening preventive services (e.g., providing consultation services and resources to workplaces, training volunteers to deliver programs/testing related to heart health). Sixty percent of demonstration projects focused on reducing tobacco use, 73% on improving nutrition, and 68% on greater physical activity. These activities primarily occurred in schools (38%), community agencies (36%), and workplaces (26%).

70% of the provincial-level programs and 94% of the community-level projects had an explicit focus on supporting community partnerships/collaborations. Among the many multi-agency demonstration projects was a community-level intervention aiming to combat obesity in 700 families in low-income, low-education settings. Networks and partnerships were critical for facilitating and coordinating the wide variety of activities in this initiative, which included aerobics classes, a walking club, nutrition and food preparation classes for adults and children, information sessions, smoking prevention programs, line dancing, community gardens, and a community kitchen. Of note, many of these initiatives have now been scaled up to province-wide programs, while a number of the interorganizational and intersectoral partnerships have persisted beyond the seven-year demonstration initiative.

Source: Conference of Principal Investigators of Heart Health.⁵⁷

A key objective of the CHHI was to increase the capability of member organizations to promote health at a population level; this goal is not reflected in Provan's network performance criteria.³⁰ Nevertheless, evaluations of the CHHI noted improvements in organizations' capacity to provide heart health promotion activities, in particular enhanced knowledge use, skill development, new infrastructure, stronger leadership, and an embedded priority for CHHI activities.^{33,35,44,45} However, the gradual nature of organization capacity building for integrated prevention activities and the long-term goals of preventive services suggest that the full impact of the CHHI on member organizations and population outcomes remains to be fully assessed.^{44,45}

MAKING NETWORKS MORE SUCCESSFUL

The experiences of Alberta's PCNs and the CHHI help to identify what characteristics of network structure, development, and governance may be important to consider when examining network performance, as well as the types of outcomes that are relevant to prevention-oriented networks that may not easily align with existing classification tools. It is important to note that the outcome classification framework proposed by Provan et al.³⁰ and employed in our analysis was not developed with prevention-specific uses in mind. Despite this, our analysis suggests this framework may be usefully applied to individually oriented, service-based prevention networks such as the PCNs (although opportunities for refinement exist). For population-wide chronic disease prevention networks that span multiple sectors and jurisdictions (such as the CHHI), additional outcomes and measures may be needed to better understand the function and impact of these networks. A collaborative program of research explicitly focused on assessing and improving the performance of prevention-oriented networks is needed.

Our analysis points to 2 interrelated components of this future research program: performance assessment tools developed specifically for chronic disease prevention networks and use of these tools by different stakeholders to drive performance improvement. These components may be useful starting points on

which to structure ongoing investigations into networks for strengthening prevention in health systems.

Improving Assessment of Network Performance

As shown by the CHHI and PCN examples, prevention network performance evaluation may require methods that differ from assessment of other types of networks. Typical measures of network structure and process, such as range of services, network costs, and number of network members, go some way to understanding network performance, particularly in individually based service-oriented networks such as PCNs. However, additional markers may be of value to population-based preventive networks, such as transparency of intersector governance structures and effectiveness of capacity-building processes. Moreover, in multisector, multilevel prevention networks, measures that help to clarify the role of governance structures (e.g., multiagency agreements) in combination with measures of governance processes (e.g., the operation of network activities outside traditional governance arrangements) appear to be particularly important. Other tools that help map network structures and processes (such as social network analyses) are also important, yet do not appear to be standard elements of network evaluations in chronic disease prevention.

For measuring network outcomes, Provan and Milward's evaluative framework highlights some of the factors that are important to consider at the community, network, and organization levels.³⁰ Specific aspects of network performance for prevention require additional exploration. Among these are outcome measures focused on the long-term impact of the network, how the network integrates across sectors as well as providers, the legitimacy of network involvement, and the organization capacity generated by the network to deliver preventive programs. Outcome measures for chronic disease prevention networks may also need to be developed for patient reports (adapted to the population focus of prevention networks), the legacy left by past networks, the influence of networks on other preventive activities, and the capacity of networks to address common underlying risk factors shared by multiple chronic

diseases. Developing a systematic and rigorous measurement strategy for assessing network performance is therefore a difficult task that needs to include outcome measures that reflect the population-wide focus and long-term nature of preventive work. Moreover, these outcomes are likely to be context sensitive, requiring tools that flexibly consider the impact of sociopolitical contexts of local health systems, including their

targets (public health organizations or community-based coalitions), objects (comprehensive approach, specific programs, generic knowledge/skills), activities (research, capacity-building, or partnership approaches), [and] relationships (levels of interaction).^{42(p1047)}

The CHHI and PCNs demonstrate the importance of fostering local flexibility and developing disease prevention strategies that are context sensitive. The development of performance measures is no different, and multilevel performance measurement strategies are required for both within-network and cross-network investigations, such as is occurring in evaluations of Canada's Coalitions Linking Action and Science for Prevention.⁴⁹ Developing meaningful, actionable, and reliable assessment strategies that have contextual and comparative value will therefore require a collaborative approach that is cognizant of the needs, perspectives, and incentives of a diverse range of stakeholders.⁵⁰ A first step may be the identification of simple rules to inform network performance evaluation.⁵¹ This will require broad-based stakeholder consultation, potentially facilitated by tools such as concept mapping, which guides participants through a rigorous and structured brainstorming exercise.⁵¹ This approach could prove useful in setting the terms of the measurement agenda and the scope of network activities to be assessed, thereby providing evaluation options that foster local flexibility and creativity while generating meaningful, actionable, and comparable approaches for performance improvement.

Improving Use of Network Information

A network performance measurement agenda should also focus on how measurement data are actually used, including feedback mechanisms that facilitate the presentation of structure, process, and outcome data in

ways that improve the quality and timeliness of decision-making. Despite the power of feedback interventions, recent research suggests that they are rarely explored in investigations of complex systems.⁵²

Alberta's PCNs and the CHHI highlight some of the challenges in integrating performance measures into feedback systems. The PCN initiative has established measurement tools for monitoring service access, improving service integration, and evaluating financial status; however, it has few explicit feedback structures that link these performance targets to actions, such as access to network funding. Although resources may be withheld if performance is not aligned with goals specified in the PCN business plan, reporting requirements are almost exclusively limited to financial data. Because linking network funding to short-term financial targets is misaligned with the long-term goals of disease prevention networks, it is unclear how the current PCN financial incentive structure will shift the focus from increasing patient volume toward achieving high-quality patient and population outcomes.

Similarly, federal funding for the CHHI was allocated for relatively short periods (5 years), a framework at odds with the lengthy commitment required for prevention efforts. A set of national objectives and performance measures provided the tools for guiding funding allocation to provinces. Feedback processes included local site visits and scientific peer reviews of provincial plans, facilitating a high degree of provincial autonomy. However, although feedback processes appeared effective at creating a degree of accountability at the provincial level, CHHI operations outside the usual federal-provincial channels resulted in broken feedback loops and little accountability at the federal level, yielding few options for monitoring or addressing issues of high-level network performance.

PCNs and the CHHI demonstrate the importance of collaborative planning in developing multilevel feedback processes that link data to decisions and actions (not limited to network funding).⁵³ To truly support the pursuit of high-performing networks, we need to understand more about how network resources might be fairly and transparently linked to outcome-based performance measures through collaboratively agreed feedback

and accountability frameworks. Incentive strategies (e.g., access to nonfinancial rewards such as enhanced resource use and improved career options) need to be developed and positioned so that they support network participation and patient or population health outcomes.⁵⁴ Feedback mechanisms that form part of clear governance solutions (e.g., the PCNs' tripartite agreement) are therefore critical for ensuring that performance data are linked to action and that partner involvement is clarified, expertise is maximized, and overspecification of member activities is avoided. A comparative analysis of the feedback approaches, incentive structures, and governance models employed by different preventive networks will be an important step in improving our understanding of network performance and delineating clear responsibilities for network members.¹²

CONCLUSIONS

Networks for preventing chronic diseases and delivering more integrated services to chronic care patients are becoming important features of health systems. Not all networks will succeed in achieving their goals or ultimately improving the health of populations. Alberta's PCNs and the CHHI provide rich insights into different ways networks may be originated, implemented, funded, governed, and assessed, as well as highlighting some of the issues to be addressed in improving our understanding of networks for strengthening prevention in health systems. A systematic research agenda is needed to examine these issues and may be initially structured around the development of prevention-specific measurement strategies that facilitate improved assessment of network performance and collaboratively developed feedback mechanisms that make better use of data to drive change in network activities.

These priority research areas must form part of a program of research that seeks to integrate the expertise of clinicians, public health professionals, stakeholder engagement specialists, economists, health services and systems researchers, health policy specialists, and social scientists. The program must bridge these disciplines, build on research and practice expertise, and mobilize knowledge in

ways that improve practice. This will involve systematically identifying, analyzing, and then learning from diverse network case studies, using mixed methods, efficiently collecting new data, and making best use of routinely available sources. Such research will likely require traditional quantitative and qualitative approaches, evidence synthesis methods that recognize the critical role of context, and systems-oriented tools such as social network analyses, concept mapping, and system dynamics models.⁵⁵ Finally, this research needs to be optimally positioned at the interface of policy and practice to provide timely and meaningful input into ongoing network and preventive efforts. ■

About the Authors

Cameron D. Willis and Allan Best are with the Centre for Clinical Epidemiology and Evaluation, Vancouver Coastal Health Research Institute, and the School of Population and Public Health, University of British Columbia, Vancouver. Cameron D. Willis is also with the University of Adelaide, Adelaide, Australia. Barbara L. Riley is with the Propel Centre for Population Health Impact and the School of Public Health and Health Systems, Faculty of Applied Health Sciences, University of Waterloo, Waterloo, Ontario. Carol P. Herbert is with the Department of Family Medicine, Schulich School of Medicine and Dentistry, Western University, London Ontario.

Correspondence should be sent to Dr Cameron Willis, PhD, NHMRC Sidney Sax Fellow, Centre for Clinical Epidemiology and Evaluation, VCH Research Institute The University of British Columbia, 7th floor, 828 West 10th Ave, Vancouver, BC V5Z 1M9, Canada (e-mails: cameron.willis@ubc.ca; cameron.willis@adelaide.edu.au). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints" link.

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Contributors

C. D. Willis conceptualized the study, led the data analysis and interpretation, identified case examples, refined the analytical framework, collected and collated appropriate evidence, and drafted and revised the article. B. L. Riley, C. P. Herbert, and A. Best helped identify case examples and evidence, analyze data, interpret results, and draft and revise the article. All authors approved the final version.

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References

- Samb B, Desai N, Nishtar S, et al. Prevention and management of chronic disease: a litmus test for health-systems strengthening in low-income and middle-income countries. *Lancet*. 2010;376(9754):1785–1797.
- Rapley P, Davidson PM. Enough of the problem: a review of time for health care transition solutions for young adults with a chronic illness. *J Clin Nurs*. 2010;19(3–4):313–323.
- Ontario Medical Association. OMA policy on chronic disease management. *Ont Med Rev*. 2010:20–37.
- Macintyre NR. Chronic critical illness: the growing challenge to health care. *Respir Care*. 2012;57(6):1021–1027.
- de Savigny D, Adam T, eds. *Systems Thinking for Health Systems Strengthening*. Geneva, Switzerland: Alliance for Health Policy and Systems Research, World Health Organization; 2009.
- World Health Organization. *Everybody's Business: Strengthening Health Systems to Improve Health Outcomes: WHO's Framework for Action*. Geneva, Switzerland: World Health Organization; 2007.
- Chee G, Pielemeier N, Lion A, Connor C. Why differentiating between health system support and health system strengthening is needed. *Int J Health Plann Manage*. 2013;28(1):85–94.
- Beaglehole R, Ebrahim S, Reddy S, Voute J, Leeder S. Prevention of chronic diseases: a call to action. *Lancet*. 2007;370(9605):2152–2157.
- Pollack HA. Prevention and public health. *J Health Polit Policy Law*. 2011;36(3):515–520.
- Mayes R, Armistead B. Chronic disease, prevention policy, and the future of public health and primary care. *Med Health Care Philos*. 2012; Epub ahead of print November 29, 2012.
- Denis JL, Davies HTO, Ferlie E, Fitzgerald L. *Assessing Initiatives to Transform Healthcare Systems: Lessons for the Canadian Healthcare System*. Ottawa, Canada: Canadian Health Services and Research Foundation; 2011. CHSRF Series on Healthcare Transformation 1.
- Huerta TR, Casebeer A, Vanderplaat M. Using networks to enhance health services delivery: perspectives, paradoxes and propositions. *Healthc Pap*. 2006;7(2):10–26.
- McInnes E, Middleton S, Gardner G, et al. A qualitative study of stakeholder views of the conditions for and outcomes of successful clinical networks. *BMC Health Serv Res*. 2012;12:49.
- Best A, Holmes B. Systems thinking, knowledge and action: towards better models and methods. *Evid Policy*. 2010;6(2):145–159.
- Best A, Greenhalgh T, Lewis S, Saul JE, Carroll S, Bitz J. Large-system transformation in health care: a realist review. *Milbank Q*. 2012;90(3):421–456.
- Shortell SM, Gillies RR, Anderson DA. The new world of managed care: creating organized delivery systems. *Health Aff (Millwood)*. 1994;13(5):46–64.
- Shortell SM, Gillies RR, Anderson DA, Mitchell JB, Morgan KL. Creating organized delivery systems: the barriers and facilitators. *Hosp Health Serv Adm*. 1993;38(4):447–466.
- Nemis-White J, Mackillop J, Montague T. Canada's future healthcare: can it be better? Will it be better? *Healthc Pap*. 2012;12(2):51–59, discussion 66–70.
- Burns LR, Pauly MV. Accountable care organizations may have difficulty avoiding the failures of integrated delivery networks of the 1990s. *Health Aff (Millwood)*. 2012;31(11):2407–2416.
- Nuño R, Coleman K, Bengoa R, Sauto R. Integrated care for chronic conditions: the contribution of the ICC Framework. *Health Policy*. 2012;105(1):55–64.
- Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. *Milbank Q*. 1996;74(4):511–544.
- Barr VJ, Robinson S, Marin-Link B, et al. The expanded chronic care model: an integration of concepts and strategies from population health promotion and the chronic care model. *Hosp Q*. 2003;7(1):73–82.
- Leatt P, Pink GH, Guerriere M. Towards a Canadian model of integrated healthcare. *Healthc Pap*. 2000;1(2):13–35.
- Brass DJ, Galaskiewicz J, Greve HR, Tsai W. Taking stock of networks and organizations: a multilevel perspective. *Acad Manage J*. 2004;47(6):795–817.
- Provan KG, Fish A, Sydow J. Interorganizational networks at the network level: a review of the empirical literature on whole networks. *J Manage*. 2007;33(3):479–516.
- Borgatti SP, Foster PC. The network paradigm in organizational research: a review and typology. *J Manage*. 2003;29(6):991–1013.
- Varda D, Shoup JA, Miller S. A systematic review of collaboration and network research in the public affairs literature: implications for public health practice and research. *Am J Public Health*. 2012;102(3):564–571.
- Provan KG, Kenis P. Modes of network governance: structure, management, and effectiveness. *J Public Adm Res Theory*. 2008;18(2):229–252.
- Woulfe J, Oliver TR, Zahner SJ, Siemering KQ. Multisector partnerships in population health improvement. *Prev Chronic Dis*. 2010;7(6):A119.
- Provan KG, Milward HB. Do networks really work? A framework for evaluating public-sector organizational networks. *Public Adm Rev*. 2001;61(4):414–423.
- Jeffers B, Relf M, Prince G. Primary care networks in Alberta. Paper presented at: National Healthcare Leadership Conference; June 2, 2008; Saskatoon, Saskatchewan, Canada.
- Jackson SF, Riley BL. Health promotion in Canada: 1986 to 2006. *Promot Educ*. 2007;14(4):214–218.
- Conference of Principal Investigators of Heart Health. *Canadian Heart Health Initiative: Process Evaluation of the Demonstration Phase*. Ottawa, Ontario: Health Canada, WHO Collaborating Centre for Policy Development in the Prevention of Noncommunicable Disease; 2001.
- Riley BL, Stachenko S, Wilson E, et al. Can the Canadian Heart Health Initiative inform the population Health Intervention Research Initiative for Canada? *Can J Public Health*. 2009;100(1):Suppl I20–I26.
- Elliott SJ, Taylor SM, Cameron R, Schabas R. Assessing public health capacity to support community-based heart health promotion: the Canadian Heart Health Initiative, Ontario Project (CHHIOP). *Health Educ Res*. 1998;13(4):607–622.
- Primary Care Initiative Policy Manual*. Edmonton, Canada: Government of Alberta; 2008.
- Manns BJ, Tonelli M, Zhang J, et al. Enrolment in primary care networks: impact on outcomes and processes of care for patients with diabetes. *CMAJ*. 2012;184(2):E144–E152.
- Hall L, Krajnak J. What does success look like in primary care networks? Would we know it if we saw it? Paper present at: National Healthcare Leadership Conference; June 8, 2010; Winnipeg, Manitoba, Canada.
- Palmer CPC. Models: governance: the Alberta PCI experience. Paper presented at: College of Family Physicians of Canada Primary Care Forum; November 26–27; Toronto, Ontario.
- College of Family Physicians of Canada. Appendix 2: Alberta primary care networks, establishing the primary care network legal relationship: 2007. Available at: <http://toolkit.cfp.ca/en/governance/appendix-2-alberta-primary-care-networks-governance-issues.php>. Accessed June 12, 2012.
- Primary Care Initiative Evaluation Summary Report*. Edmonton, Canada: R. A. Malatest & Associates Ltd; 2011.
- Masuda JR, Robinson K, Elliott S, Eyles J. Disseminating chronic disease prevention “to or with” Canadian public health systems. *Health Educ Behav*. 2009;36(6):1026–1050.
- Rocan C. Multi-level collaborative governance: the Canadian Heart Health Initiative. *Optimum Online*. 2009;39(4):1–16.
- Robinson K, Farmer T, Elliott SJ, Eyles J. From heart health promotion to chronic disease prevention: contributions of the Canadian Heart Health Initiative. *Prev Chronic Dis*. 2007;4(2):A29.
- Robinson K, Farmer T, Riley B, Elliott SJ, Eyles J. Realistic expectations: investing in organizational capacity building for chronic disease prevention. *Am J Health Promot*. 2007;21(5):430–438.
- Alberta Medical Association. How are primary care networks (PCNs) improving health care in Alberta? 2011. Available at: <https://http://www.albertadoctors.org/services/physicians/practice-help/primary-care/pcns/how-are-primary-care-networks-pcns-improving-health-care-in-alberta>. Accessed June 13, 2012.
- Jones DC, Ludwick D, Brass N, Cutts C. Suburban cardiac screening: improving access to specialist services within a primary care network. *Healthc Manage Forum*. 2011;24(1):20–24.
- Jones D, Carroll L, Frank L. After-hours care in suburban Canada: influencing emergency department utilization. *J Prim Care Community Health*. 2011;2(4):250–254.
- Manafò E, Petermann L, Lobb R, Keen D, Kerner J. Research, practice, and policy partnerships in pan-Canadian coalitions for cancer and chronic disease prevention. *J Public Health Manag Pract*. 2011;17(6):E1–E11.

50. Riley BL, Cameron R, Campbell HS, Manske SR, Lamers-Bellio K, Czukur D. Common measures to advance the science and practice of population intervention for chronic disease prevention: the promise and two early experiences in tobacco control. *Can J Program Eval*. 2012;24(3):39–58.
51. Trochim WMK. An introduction to concept mapping for planning and evaluation. *Eval Program Plann*. 1989;12(1):1–16.
52. Finegood DT. The complex systems science of obesity. In: Cawley J, ed. *Handbook of the Social Science of Obesity*. New York, NY: Oxford University Press; 2011:208–236.
53. Ottoson JM, Wilson DH. Did they use it? Beyond the collection of surveillance information. In: McQueen DV, Puska P, eds. *Global Behavioral Risk Factor Surveillance*. New York, NY: Kluwer Academic/Plenum Publishers; 2003:119–130.
54. Rigby E. How the National Prevention Council can overcome key challenges and improve Americans' health. *Health Aff (Millwood)*. 2011;30(11):2149–2156.
55. Willis CD, Mitton C, Gordon J, Best A. System tools for system change. *BMJ Qual Saf*. 2012;21(3):250–262.
56. Manns BJ, Tonelli M, Zhang J, et al. Enrolment in primary care networks: impact on outcomes and processes of care for patients with diabetes. *CMAJ*. 2012; 184(2):E144-E152.
57. Conference of Principal Investigators of Heart Health. *Canadian Heart Health Initiative: Process Evaluation of the Demonstration Phase*. Ottawa, Ontario: Health Canada, WHO Collaborating Centre for Policy Development in the Prevention of Noncommunicable Disease; 2001.