For Discussion: A Roadmap for Population-Based Information Systems to Enhance Primary Healthcare in Canada

Pour discussion : feuille de route pour les systèmes d'information démographique afin de renforcer les soins de santé primaires au Canada

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Abstract

The purpose of this paper is to promote expansion of population-based information systems to enhance primary healthcare renewal (PHC) across Canada. The vision is to ensure that healthcare policy makers, managers and clinical leaders receive relevant, valid and timely information that is useful to them in exercising their responsibilities in accountability and performance improvement. The paper sketches a roadmap of options for new information systems and describes the opportunities and limitations associated with each. The intent is to offer an array of alternatives for consideration because jurisdictions vary in their vision and objectives for renewal and priorities for information.

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Résumé

L'objet de cet article est de promouvoir la mise en place de systèmes d'information démographique afin de renforcer la restructuration des soins de santé primaires (SSP) au Canada. La vision est d'assurer que les responsables des politiques de santé, les gestionnaires et les dirigeants cliniciens aient accès à une information pertinente, valable et actuelle qui soit utile pour l'exercice de leurs responsabilités en termes d'obligation redditionnelle et d'amélioration du rendement. L'article présente les grandes lignes d'une feuille de route offrant différents choix pour la création de nouveaux systèmes d'information et décrit les possibilités et les limites associées à chacun d'eux. L'idée est d'offrir un éventail de choix, étant donné la diversité de visions et d'objectifs en matière de priorités et de restructuration de l'information qu'on retrouve auprès des différentes autorités.

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In 2003, the British Columbia Ministry of Health initiated a series of investments to have the Centre for Health Services and Policy Research at the University of British Columbia establish a population-based information system to describe the primary healthcare (PHC) system from temporal, geographic, population and provider perspectives (Watson 2009). Our vision at the time and to this day is to ensure that healthcare policy makers, managers and clinical leaders receive relevant, valid and timely information that is useful to them in exercising their responsibilities in accountability and performance improvement. It is now 2009, and we have the benefit of hindsight, more experience working with experts across Canada and at Statistics Canada in particular, and more opportunities for vicarious learning to contemplate future work in Canada towards that same vision.

To conclude this special issue of *Healthcare Policy*, this paper is intended to inform government investments in population-based PHC information systems designed to fill information gaps in areas of high priority and unmet need. First, I revisit lessons learned from the British Columbia experience that are relevant today to the design of enhanced information systems to support PHC renewal. I then propose a roadmap of options for new information systems and outline the opportunities and limitations associated with each option. The intent is to offer an array of alternative new data structures that complement existing ones, because jurisdictions across the country vary in their vision and objectives for renewal as well as priorities for information and capacity to collect data (Health Council of Canada 2008). Irrespective of this diversity, nationwide consultations with policy makers and managers suggest consensus on the need for more and better data, information and knowledge management strategies (Law et al. 2007).

In the area of PHC, information systems should be designed to (a) create indicators that can be used to monitor equity, effectiveness, efficiency and responsiveness

by measuring the unique and distinguishing features of PHC services as well as the contexts, inputs, activities and outcomes of care (hereafter referred to as "monitoring information") and (b) support analyses regarding the factors that underlie desirable changes in structure, process and outcomes ("improvement information"). The same system can be designed to create both types of information. Alternatively, databases can be merged through data linkage to create improvement information.

Monitoring information can be used to meet accountability responsibilities and also to support performance improvement by identifying things that are done well or not. For example, indicators that measure the percentage of people with diabetes who receive recommended care, appropriately self-monitor their blood pressure and sugar levels and are admitted to hospital for complications offer insights regarding the effectiveness of PHC. Indicators of this type can be sourced piecemeal from an array of existing data sources and from different databases (Broemeling et al. 2009, see page 49; CIHI 2006a).

In contrast, improvement information supports renewal efforts by providing perspectives about what can be done to leverage the speed and direction of change. For example, improvement information can be created through attribution analyses identifying the factors (e.g., structure of care such as use of case managers, patient education strategies, reminder systems and/or electronic health records) that increase the likelihood of people with diabetes getting recommended care or appropriately self-monitoring their blood pressure and sugar levels. It can also be used to determine the extent to which these care processes affect the likelihood of hospitalization for people with complications due to diabetes. Importantly, the creation of this information requires that data regarding structure, care processes or both (e.g., whether or not someone who has diabetes receives recommended care) can be linked with outcome data (e.g., hospitalization for complications). Thus, these data must reside in the same database or be linkable at the organization, provider and/or patient levels to support attribution analyses or causal inferences regarding the structures and processes underlying better care and outcomes. Strategies to create improvement information are the primary focus of the roadmap of options for new data structures proposed later in this paper.

The topic of enhancing capacity to generate population-based information about PHC renewal and its progress is timely given:

- the magnitude of public investments over the past decade and action on the ground to improve the performance of this sector (Government of Canada 2000, 2003, 2004);
- evidence that strong PHC systems improve the equity, effectiveness and efficiency of healthcare systems (Atun 2004) and that Canadians' experiences with PHC services influence their confidence in the healthcare system and their views on the necessity of reform (Watson, Sanmartin et al. submitted).

What lessons does British Columbia's experience hold today for the design of enhanced information systems?

Enhance Information Systems in Areas of High Priority and Unmet Need

New or expanded information systems should leverage current measurement, monitoring and reporting efforts, as well as create data structures designed to fill gaps in information in areas of high priority and unmet need.

In accordance with their accountability to Canadians, policy makers and managers should monitor and report on the unique and distinguishing features of PHC services that are important to the public. In order to identify priorities in this area, we conducted work in British Columbia to identify the features of PHC services that residents think are important and mention in discussions regarding what could be improved. Analysis of focus group discussions held in 2005 revealed the importance of six domains: accessibility (geographic access and timeliness), continuity, responsiveness, interpersonal communication, technical quality and whole-person care. Although participants discussed accessibility most frequently, domains more often associated with satisfaction were interpersonal communication and continuity (Wong et al. 2008). Berta and colleagues (2008) conducted focus groups and nationwide surveys in 2001 and 2004 to identify priorities for public reporting and concluded that Canadians value information regarding PHC physicians' technical and communication skills.

In 2008, Statistics Canada conducted the Canadian Survey of Experiences with Primary Health Care (CSE-PHC) with sponsorship from the Canadian Institute for Health Information (CIHI) and the Health Council of Canada to provide nationwide and provincial-level data necessary to fill gaps in these areas of unmet need for monitoring information in areas of high priority to Canadians (Watson, Poulin et al. submitted).

To fulfill their responsibilities in improving healthcare performance, policy makers and managers also need information about factors that underlie desired change in the speed and direction of PHC renewal. That is, they need data to support attribution analyses or causal inferences regarding the factors associated with better care and outcomes. The First Ministers and federal, provincial and territorial ministers of health have tied significant investments in the sector to goals and objectives for PHC renewal (Health Council of Canada 2008). Those covenants with Canadians reflect federal and provincial/territorial agreement regarding priorities for information for the purposes of accountability and performance improvement. The CSE-PHC was also designed to fill gaps in need for improvement information in some of these areas (Watson, Poulin et al. submitted). In the future, analyses of these and other new data

structures will be needed to generate monitoring and improvement information in these areas of government priority for PHC renewal.

Previously, in 2005, CIHI had been commissioned by Health Canada on behalf of all governments to achieve national consensus among policy makers and managers on a core set of indicators for this sector. A broad range of PHC experts from multiple levels of the health system and regions identified 105 indicators as important, of which only 15 could be tracked using existing information systems (CIHI 2006b). The CSE-PHC will provide nationwide and provincial-level data to fill many of the existing gaps required to create monitoring and improvement information.

In 2007, the Canadian Health Services Research Foundation and its partners undertook nationwide consultations with governments, administrators, clinicians and researchers to identify priorities for information and research (Law et al. 2007). Many of the 11 themes that emerged will require enhanced PHC information systems, including the themes "patient flow and system integration," "chronic disease prevention and management" and "linking population and public health to health services." There was also a call for improvement information to support "change management for improved practice and improved health." While this special issue of *Healthcare Policy* is intended to share insights about how to leverage existing data capacity for these purposes, this paper focuses on how new data structures can fill gaps in unmet need for monitoring and improvement information where there is no capacity.

Expand Information Systems to Link PHC Inputs to Information on Processes and Outcomes

We have demonstrated in another paper (Broemeling et al. 2009) that relatively accurate information systems exist in Canada to measure and monitor PHC inputs: the fiscal and human resources used to deliver care. Those information systems principally rely on fee-for-services payment data and centre on physician inputs, activities and outputs. Insofar as jurisdictions move to other forms of remuneration, in the future, new information systems that support those approaches to funding should not result in erosion of capacity to use payment data to understand the PHC sector from geographic, temporal, population and provider perspectives.

Unfortunately, there are no nationwide data standards for these new payment data. Such standards are needed to strengthen the degree to which routinely collected data can be used to create monitoring or improvement information. At a minimum, these standards should ensure capacity to link existing with new payment data files so as to retain capacity to measure and monitor the following constructs at the population level: the healthcare professional and patient who delivered/received a PHC serv-

ice, the date and location of the service and the type of care. As described throughout this special issue, such information is required to continue monitoring temporal trends and regional shifts in PHC inputs and outputs from supply and patient perspectives and to clarify the effects of variation in inputs and activities on processes of care.

Importantly, CIHI has developed new population-based information systems to count and describe the workforce of non-physician healthcare professionals. To date, many of these information systems do not enable analysts to determine the sector(s) in which each provider works and the location(s) where he or she works. In the future, this information will be vital to collect. In this special issue, we describe work in British Columbia to use one of these databases to identify registered nurses who practice in the PHC sector (Wong et al. 2009). This type of data will be required to monitor achievement of First Ministers' commitments to expanding access to multi-disciplinary PHC teams (Government of Canada 2000, 2003, 2004).

In the future, these and other similar systems must be designed and used to track the types of services delivered by PHC providers from an array of disciplines, together with the patients to whom those services are provided. Thus, the above-mentioned data about providers should be linkable to data regarding processes of care so as to support, for example, attribution analyses and causal inferences regarding the optimal mix of healthcare providers, as well as related issues, such as the impact of substituting one type of provider for another on processes and outcomes of care. Only then will we understand the high-priority issues related to sufficiency of supply of health human resources and opportunities to leverage overlaps in scope of practice.

We have demonstrated in another paper (Broemeling et al. 2009) that population-based information systems in Canada are inadequate to measure the unique and distinguishing features of PHC (i.e., accessibility, continuity, comprehensiveness and technical quality) as well as the immediate, intermediate and final outcomes of this sector. While there have been some studies designed to support ad hoc collection of these data at a local or regional level, as well as a recent one-time investment in the CSE-PHC to collect these data at a provincial level, there is no nationwide strategy to collect these data routinely at levels of analyses or over periods of time that optimally support accountability and healthcare performance improvement. At a minimum, this type of information should be accessible at the provincial level. Pilot work, funded by CIHI, is currently underway to determine how this information gap might best be filled.

In the future, existing information systems about doctors and other healthcare professionals should be linkable to data regarding the context, structure and process of care as well as patient, provider and healthcare system outcomes. This is the only type of information that can support attribution analyses and causal inferences regarding the combination of inputs, activities and outputs, together with their contexts, that result in desired immediate, intermediate and final outcomes for various segments of the population (Watson et al. 2009). Only then will we have improvement informa-

tion to support decisions regarding the optimal mix of strategies to support PHC renewal in ways envisioned by First Ministers, Ministers of Health and Canadians. The challenge is to identify the most cost-effective, robust strategy to expand information systems by creating new data structures in ways that support the creation of monitoring and improvement information in areas of high priority and unmet need.

A Roadmap of Options

Where should Canada best invest in new or expanded PHC information systems?

Until such time as electronic health and medical records offer complete and accurate information regarding PHC services and longitudinal, patient-centred profiles of utilization and outcomes across primary, secondary and tertiary care for all Canadians, jurisdictions across the nation should move towards investments in strategies that leverage their existing administrative data and rely on new data structure(s) to collect data sampled to represent geographic and high-priority populations. Canada would not be alone in adopting such a strategy, which is also used in Australia, the United Kingdom and the United States.

If the intent of this new strategy is to generate monitoring and improvement information, then it seems logical to attain a representative sample of PHC organizations and, then, of providers and patients nested in those organizations (supply-based approach). Prospectively, however, this approach should be considered in light of other alternatives vis-à-vis its potential to create a complete, accurate and useful data structure to support creation of monitoring and improvement information for accountability and performance improvement. For example, one alternative is to obtain a representative sample of Canadians and then use a longitudinal approach prospectively to measure care experiences and outcomes, as well as the characteristics, of PHC and other organizations from which people seek healthcare (patient-based approach). One hybrid alternative is a supply-based approach that simultaneously involves following selected patients over a longer period (i.e., find provider, follow patients). Another hybrid uses a patient-based approach that involves retrospectively selecting PHC organizations from which patients have already received care (i.e., follow patients, find providers). Thus, it is important to understand the opportunities and limitations associated with an array of options.

Supply-based approach

A supply-based approach to creating a data structure has been used by researchers in the United States to examine the quality of primary and community care (McGlynn et al. 2003). In that country, however, most health insurance organizations limit the number of different physicians that patients visit by prospectively providing beneficiar-

ies with a list of "preferred providers" who are eligible to bill the insurer. In this context, insurers' rosters of beneficiaries are used as a sample frame to identify cohorts of survey respondents. Because these patients see a limited number of different preferred providers, the full scope of healthcare interventions can be measured. Thus, when this type of data structure is used in the United States it can support attribution analyses and causal inferences regarding the impact of PHC services on patient experiences and outcomes.

In Canada, however, people can choose to visit many different physicians, and they often do. It has been estimated that people in Manitoba visit a general practitioner or family physician (GP/FP) an average of 3.5 times but see an average of two different GP/FPs each year (Watson et al. 2004). The story is more complex from a supply-based perspective. It has been estimated that the median number of other physicians (GP/FPs and specialists) seen by all patients that receive the majority of their care from a GP/FP (which is usually only half the patients seen by these practitioners) is 250 (Reid et al. 2003a). While there is growth in the number of GP/FP group practices, and one might presume that there would be more patient sharing within groups and less use of other GP/FPs, this does not seem to be the case (Reid et al. 2003b). This evidence reflects the fact that there is little incentive other than a patient's desire for relationship continuity to limit the number of different GP/FPs or PHC organizations visited or, conversely, that there are few mechanisms for GP/FPs to determine which patients consider them their regular or majority source of care.

Thus, a supply-based approach in Canada that would entail recruitment of a representative sample of PHC organizations should be used principally to generate monitoring information regarding PHC inputs, activities and outputs. It could not, however, be used to generate the most robust improvement information regarding the impact of PHC providers and their organizations on patient outcomes that occur over the course of time. Why? As time passes, too many patients seen by each PHC organization in Canada can be expected to receive care from other PHC organizations. Yet any significant shift towards rostering of populations across a province or territory would increase the likelihood that a supply-based approach would be viable in terms of building a complete and accurate data structure to support the creation of monitoring and improvement information regarding patient outcomes that occur over time.

A supply-based approach to designing a new data structure, therefore, requires that the sampling and measurement strategies recognize and account for the degree to which PHC organizations in Canada provide some or all of their services to the patients they serve. This is less important when generating monitoring or improvement information at the encounter level regarding services (e.g., did the provider deliver recommended care during an encounter) or experiences (e.g., satisfaction with interpersonal communication during an encounter) and more important when measuring outcomes that occur over the course of time (e.g., reduced downstream effects

of chronic health conditions). It is less important when generating monitoring or improvement information regarding short-term patient outcomes (e.g., duration of an acute episode) and more important when generating improvement information about long-term outcomes (e.g., risk of an avoidable complication).

There is sufficient evidence from international experiences that valuable information can be extracted from supply-based PHC information systems that rely on geographic sampling, and there are researchers in Canada who have used this approach (e.g., Haggerty et al. 2008). In 1998, the Australian Institute of Health and Welfare and the Department of Health and Ageing began to fund BEACH (Bettering the Evaluation and Care of Health; www.fmrc.org.au/beach.htm) in order to measure and describe processes of care that occur during encounters between general practitioners and patients. The BEACH program continuously collects information about clinical activities in Australia, including characteristics of general practitioners, patients seen, reasons people seek medical care and problems managed. Each problem identified is linked to medications prescribed, advised, provided; clinical treatments and procedures provided; referrals to specialists and allied health services; and tests ordered, including pathology and imaging. The process entails a random sample of 1,000 general practitioners annually (identified as in active practice using medicare records) who participate in data collection by offering information regarding 100 consecutive consultations. Supplemental data are collected and analyzed on an ad hoc topical basis for the purposes of generating improvement information. This data system has been used to assess, for example, (a) risk factors for ill health such as co-morbidity, (b) workforce issues such as length of consultations, (c) the appropriateness of care for asthma, cardiovascular disease, hypertension, depression, influenza and chronic pain and (d) post-market surveillance of a broad array of prescription medications (Britt et al. 2007).

Another international example is the National Ambulatory Medical Care Survey (NAMCS; www.cdc.gov/nchs/express.htm), which is designed to meet the need for objective, reliable information about the provision and use of ambulatory medical care services in the United States. This strategy involves the annual collection of data from office-based specialist and generalist physicians. During each sampled physician's one-week survey period, data from a systematic random sample of visits are recorded by the physician on an encounter form provided for that purpose. Data are obtained on patients' symptoms, physicians' diagnoses and medications ordered or provided. The survey also records information on the demographic characteristics of patients and services provided, including diagnostic procedures, patient management and planned treatment.

Both the BEACH and NAMCS examples collect information about encounters, but their approach could be modified to collect information about episodes of illness or long-term patient outcomes. This idea is explored more fully under the "find providers, follow patients" option described below.

Patient-based approach

Given the degree to which patients visit an array of PHC organizations across Canada and growth in interest regarding the impact of variations in mix of primary, specialty and tertiary care on outcomes that occur over time, it seems logical to consider a patient-based approach that would entail recruitment of a representative sample of Canadians. Such an approach could be cross-sectional or longitudinal (prospective or retrospective) and designed to measure PHC contexts, care experiences and outcomes, as well as the characteristics of PHC organizations and others (e.g., specialists and hospitals) from which health services were received. This approach recognizes the degree to which Canadians visit different PHC organizations and the contribution of different types of providers. The resultant data structure could be used to generate monitoring and improvement information.

A patient-based approach to designing a data structure also requires that the sampling or measurement strategy (or both) recognize and account for the degree to which Canadians need or use more than one PHC organization. This is less important when generating monitoring and improvement information regarding encounters for care (e.g., did the provider deliver recommended care during an encounter) or experiences (e.g., satisfaction with an encounter) and more important when generating improvement information regarding outcomes. It is less important when generating improvement information about short-term outcomes (e.g., satisfaction with an encounter) and more important vis-à-vis long-term outcomes related to an episode of illness (e.g., duration of an acute episode) or a chronic health condition (e.g., risk of an avoidable complication).

There is sufficient evidence from domestic experiences that valuable information can be obtained from surveys that rely on geographic sampling. Extensive use of the Canadian Community Health Survey (CCHS) and its special supplements (e.g., diabetes care) for the purposes of measuring performance of the PHC sector represent good examples (Sanmartin and Gilmore 2008; Health Council of Canada 2007). Another good example of the patient-based approach is the survey design that Statistics Canada used for the Canadian Survey of Experiences with Primary Health Care (CSE-PHC). Respondents to the CCHS were used as a sample frame for the CSE-PHC; respondents to the CSE-PHC were asked if their data could be linked between the two surveys (conducted one year apart) and with their hospitalization records (from prior and subsequent years).

Hybrid survey data structure: Find providers, follow patients

One alternative approach to a purely supply- or patient-based data structure is to sample PHC organizations (i.e., find providers) and then sample patients in them to measure events that occur during an encounter (e.g., did the provider deliver recommended care). Then, some patients can be sampled and followed over time (i.e., follow

patients) to track experiences with other PHC organizations and providers and to
measure use of healthcare and outcomes. This approach could track outcomes over the
course of an episode of illness (e.g., fracture) or for a defined period of time to track
outcomes relevant to high-priority populations (e.g., temporal shifts in blood sugar or
blood pressure among patients who have diabetes). It would entail the collection of
data about patient–provider encounters as well as from surveys of patients, providers
and PHC organizations.

The benefit of this data structure is that it can be used to generate monitoring
information from a representative sample of patients served by PHC organizations
and improvement information from the sample of patients selected for tracking lon-
gitudinal experiences with healthcare, as well as their short- or long-term outcomes.
Another attractive feature is that patients tracked over time could be defined pro-
spectively as those most likely to benefit from regular and ongoing contact with PHC
providers (e.g., people with chronic conditions). The challenge is to establish an opera-
tional definition of a PHC organization, identify a sample frame and recruit organiza-
tions and providers within them.

Researchers in Canada have
used this approach when assess-
ing, for example, patient outcomes
following receipt of services in
family practice, walk-in clinics
and emergency departments (e.g.,
Campbell et al. 2005). One inter-
national example is the extensive,
nationwide surveys conducted in
the United Kingdom by the Care

> Another attractive feature is that
> patients tracked over time could
> be defined prospectively as those
> most likely to benefit from regular
> and ongoing contact with primary
> healthcare providers (e.g., people with
> chronic conditions).

Quality Commission (formerly the Healthcare Commission) of patients served in the
National Health Service. Patients who receive care in hospitals, primary care trusts
and other health centres are recruited and, in some instances, followed across time.
Between January and April 2008, 69,000 patients from 152 primary care trusts com-
pleted surveys to share their experiences with general practitioners, health centres and
dentists (www.cqc.org.uk).

Hybrid survey data structure: Follow patients, find providers

Another hybrid approach is to recruit a representative sample of Canadians and meas-
ure their experiences with PHC organizations, either prospectively or retrospectively
through recall (i.e., follow patients). Then, some patients can be sampled (e.g., high-
priority populations) to track their longitudinal experiences with PHC organizations
and other providers, as well as their short-term and long-term outcomes. These PHC

organizations would be contacted for the purposes of collecting data about them and encounters between them and survey participants. This strategy would also entail the collection of data from surveys of patients and PHC organizations, as well as patient–provider encounters.

The benefit of this approach is that it results in a data structure that can generate monitoring information from the perspective of a representative sample of Canadians as well as improvement information from the sample of patients selected for the purposes of tracking longitudinal experiences. There are resource implications, however: because most Canadians don't have many interactions with PHC organizations, considerable resources would be required to track populations of low users who have relatively lower potential to benefit from PHC services. By comparison, the "find providers, follow patients" data structure more efficiently targets high users and thereby focuses data collection resources on people most likely to benefit from encounters. Additionally, the completeness of the resultant data structure and, therefore, the cost-effectiveness of this strategy are far more dependent on response rates by PHC organizations than the "find providers, follow patients" approach.

Hybrid survey data structure: Follow providers, follow patients

Another alternative worthy of consideration is to follow all Canadians and all providers in geographically sampled communities to improve understanding of the composition, structure and characteristics of PHC organizations in communities; the patient–provider processes and interactions that influence care, experiences and outcomes; and the array of contextual factors that influence patient care, experiences and outcomes. Importantly, this approach addresses measurement and attribution issues related to the high degree of "churn" between patients and providers and supports monitoring of populations, organizations and their interactions. It strikes an appealing balance between creating a data structure for monitoring versus improvement information. It is also better designed than other approaches to support the broader monitoring of change in the healthcare landscape.

This approach has been used in Quebec (Pineault et al. 2009). An international example is the strategy used by the Center for Studying Health System Change in the United States, whose core research effort is the Community Tracking Study:

> While the Community Tracking Study is national in scope, it focuses on the community level, where care is organized and delivered. The study consists of biennial visits to 12 communities and periodic national surveys of those involved in or affected by changes in the health system – namely households, physicians and employers. Conducted by telephone, the surveys are concentrated in 60 communities. (www.hschange.com)

Conclusion

In the past and across Canada, there have been many efforts to use administrative data, as well as population-based surveys of patients and providers, to describe the PHC system. Because few efforts have been made in building comprehensive information systems offering information from temporal, geographic, population and provider perspectives, all the other papers in this special issue of *Healthcare Policy* focus on efforts in British Columbia to build such a system. But much work can still be done to create population-based data structures intended to support the generation of high-priority information, particularly in areas of unmet need.

In the future, administrative and survey data about PHC physicians and other healthcare professionals should continue to be used to support accountability and performance improvement. But unlike the hospital sector, where data are routinely collected in standardized formats and used to inform policy and practice in the tertiary sector, no parallel data structure or strategy exists for the PHC sector. Existing data may therefore fall short in offering valuable monitoring and improvement information.

Expansion of current information systems and investments in new data structures will be required to support needs for monitoring and improvement information (Table 1). The approaches

> Administrative and survey data about primary healthcare physicians and other healthcare professionals should continue to be used to support accountability and performance improvement.

described in this paper recognize how Canadians use PHC services and how PHC providers deliver that care, as well as the priorities for information articulated by Canadians, First Ministers, healthcare policy makers and clinical leaders. While a number of different data structures are possible, the ideal strategy for any jurisdiction will depend on the degree to which priority is placed on monitoring versus improvement information, the degree to which organizational contexts (e.g., rostering) support or do not support the viability of an approach, whether the information is intended to represent Canadians and/or their PHC organizations, and the level of financial commitment.

A prerequisite to future adoption of any new strategy, however, is a shift among policy makers and managers in their expectations that new data structures will capture data about all Canadians in the way that administrative data once did. Until complete and accurate data from electronic health and medical records deliver on those expectations, the short-term reality is that PHC data structures designed to generate monitoring and improvement information must now rely on sampling methodologies.

These new data structures require primary data collection and analyses, which are more costly than secondary use of administrative or survey data. The return on investment in a new data structure to better support PHC renewal in Canada will be high if the strategy selected is explicitly designed towards unmet needs for information. Domestic and international experiences suggest that the return on investment will be higher if data collection is continuous and evolves to meet shifts in need for high-priority information.

TABLE 1. Summary of recommendations

Enhance information systems in areas of high priority and unmet need	PHC information systems should be designed to: (a) create indicators that can be used to monitor equity, effectiveness, efficiency and responsiveness by measuring the unique and distinguishing features of PHC services as well as the contexts, inputs, activities and outcomes of care ("monitoring information"); and (b) support analyses regarding the factors that underlie desirable changes in structure, process and outcomes ("improvement information").
	Information systems should leverage current measurement, monitoring and reporting efforts and create data structures to fill gaps in information in areas of high priority and unmet need.
Strengthen existing PHC information systems	As jurisdictions increasingly use other approaches to remuneration, nationwide data standards are required to ensure that new payment data can be used in tandem with fee-for-services data to create monitoring and improvement information.
	New population-based information systems designed to count and describe the workforce of non-physician healthcare professionals should include data regarding the sector(s) in which each provider works and the location(s) where he or she works. Ideally, these data should track the types of services provided and to whom.
Invest in new or expanded PHC information systems	Jurisdictions across Canada should move towards investments in strategies that leverage their existing administrative data and rely on new data structure(s) to collect data sampled as representative of geographic and high-priority populations. Five investment options are described; the selection of one or more approaches will depend on each jurisdiction's priorities for information and level of financial commitment.
	Current and new information systems should measure the unique and distinguishing features of PHC (i.e., accessibility, continuity, comprehensiveness and technical quality) as well as the immediate, intermediate and final outcomes of this sector.
	Monitoring and improvement information about PHC should be accessible at the provincial level, at a minimum.

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REFERENCES

Atun, R. 2004. *What Are the Advantages and Disadvantages of Restructuring a Health Care System to Be More Focused on Primary Care Services?* Copenhagen: WHO Regional Office for Europe.

Berta, W., J. Barnsley, A. Brown and M. Murray. 2008. "In the Eyes of the Beholder: Population Perspectives on Performance Priorities for Primary Care in Canada." *Healthcare Policy* 4(2): 86–100.

Britt, H., G.C. Miller, J. Henderson and C. Bayram. 2007 (July). *Patient-Based Substudies from BEACH: Abstracts and Research Tools. 1999-2006.* Sydney: Australian GP Statistics and Classification Centre.

Broemeling, A.-M., D.E. Watson, C. Black and S.T. Wong. 2009. "Measuring the Performance of Primary Healthcare: Existing Capacity and Potential Information to Support Population-Based Analyses." *Healthcare Policy* 5(Sp): 47–64.

Campbell, M.K., R.W. Silver, J.S. Hoch, T. Østbye, M. Stewart, J. Barnsley, B. Hutchison, M. Mathews and C. Tyrrell. 2005 (January). "Re-utilization Outcomes and Costs of Minor Acute Illness Treated at Family Physician Offices, Walk-in Clinics and Emergency Departments." *Canadian Family Physician* 51: 82–83.

Canadian Institute for Health Information (CIHI). 2006a. *Enhancing the Primary Health Care Data Infrastructure in Canada: Pan-Canadian Primary Health Care Indicator Development Project. Report 2.* Ottawa: Author.

Canadian Institute for Health Information (CIHI). 2006b. *Pan-Canadian Primary Health Care Indicators. Report 1, Vol. 1.* Ottawa: Author.

Government of Canada. 2000. "Communiqué on Health: First Ministers' Meeting, September 11, 2000." News release. Ottawa: Canadian Intergovernmental Conference Secretariat.

Government of Canada. 2003. *2003 First Ministers' Accord on Health Care Renewal.* Ottawa: Health Canada.

Government of Canada. 2004. *First Ministers' Meeting on the Future of Health Care 2004: A 10-Year Plan to Strengthen Health Care.* Ottawa: Health Canada.

Haggerty, J.L., R. Pineault, M.D. Beaulieu, Y. Brunelle, J. Gauthier, F. Goulet and J. Rodrigue. 2008. Practice Features Associated with Patient-Reported Accessibility, Continuity, and

Coordination of Primary Healthcare. *Annals of Family Medicine* 6(2):116–23.

Health Council of Canada. 2007. *Population Patterns of Chronic Health Conditions in Canada: A Data Supplement to Why Health Care Renewal Matters: Learning from Canadians with Chronic Health Conditions.* Toronto: Author.

Health Council of Canada. 2008. *Fixing the Foundation: An Update on Primary Health Care and Home Care.* Toronto: Author.

Law, S., C. Flood and D. Gagnon on behalf of the Listening for Direction III Partners. 2007. *Listening for Direction III: National Consultation on Health Services and Policy Issues, 2007–2010.* Ottawa: Canadian Health Services Research Foundation.

McGlynn, E.A., S.M. Asch, J. Adams, J. Keesey, J. Hicks, A. DeCristofaro and E.A. Kerr. 2003. "The Quality of Health Care Delivered to Adults in the United States." *New England Journal of Medicine* 348(26): 2635–45.

Pineault, R., JF Levesque et al. 2009. *Accessibility and Continuity of Care : A Study of Primary Healthcare in Quebec.* Montréal. Agence de la santé et des services sociaux de Montréal.

Reid, R.J., M.L. Barer, R. McKendry, K.M. McGrail, B. Prosser, B. Green, R.G. Evans, E. Goldner, C. Hertzman and S.B. Sheps. 2003a. *Patient-Focused Care Over Time: Issues Related to Measurement, Prevalence and Strategies for Improvement among Patient Populations.* Vancouver: Centre for Health Services and Policy Research.

Reid, R. et al. 2003b. "How Many Other Doctors Do My Patients See? The Phenomenon of 'Patient Sharing' in British Columbia." Unpublished manuscript.

Sanmartin, C. and J. Gilmore. 2008. "Diabetes: Prevalence and Care Practices." *Health Reports* 19(3): 59–63.

Watson, D.E. 2009. "The Development of a Primary Healthcare Information System to Support Performance Measurement and Research in British Columbia." *Healthcare Policy* 5(Sp): 16–22.

Watson, D.E., B. Bodganovic, P. Heppner, A. Katz, R. Reid and N. Roos. 2004. *Supply, Availability and Use of Family Physicians in Winnipeg.* Winnipeg: Manitoba Centre for Health Policy.

Watson, D.E., A.-M. Broemeling and S. T.Wong. 2009. "A Results-Based Logic Model for Primary Healthcare: A Conceptual Foundation for Population-Based Information Systems." *Healthcare Policy* 5(Sp): 33–46.

Watson, D.E., D. Poulin, K. Leeb, C. Sanmartin and T. Dufour. Submitted. "Canadian Survey of Experiences with Primary Healthcare: Development, Validation and Use."

Watson, D.E., C. Sanmartin, K. Leeb, S. Khan and C. McIntosh. Submitted. "Confidence in the Healthcare System: The Role of Primary, Secondary and Tertiary Care."

Wong, S., D.E. Watson, E. Young and S. Regan. 2008. "What Do People Think Is Important about Primary Healthcare?" *Healthcare Policy* 3(3): 89–104.

Wong, S., D.E. Watson, E. Young and D. Mooney. 2009. "Supply and Distribution of Primary Healthcare Registered Nurses in British Columbia." *Healthcare Policy* 5(Sp): 91–104.