

HEALTHCARE

# POLICY

## Politiques de Santé

*Health Services, Management and Policy Research  
Services de santé, gestion et recherche de politique*

**Volume 5 + Special Issue + November 2009**

*The Development of a Primary  
Healthcare Information System to  
Support Research, Evaluation  
and Monitoring in British Columbia*

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*Healthcare Policy/Politiques de Santé* seeks to bridge the worlds of research and decision-making by presenting research, analysis and information that speak to both audiences. Accordingly, our manuscript review and editorial processes include researchers and decision-makers.

We publish original scholarly and research papers that support health policy development and decision-making in spheres ranging from governance, organization and service delivery to financing, funding and resource allocation. The journal welcomes submissions from researchers across a broad spectrum of disciplines in health sciences, social sciences, management and the humanities and from interdisciplinary research teams. We encourage submissions from decision-makers or researcher–decision-maker collaborations that address knowledge application and exchange.

While *Healthcare Policy/Politiques de Santé* encourages submissions that are theoretically grounded and methodologically innovative, we emphasize applied research rather than theoretical work and methods development. The journal maintains a distinctly Canadian flavour by focusing on Canadian health services and policy issues. We also publish research and analysis involving international comparisons or set in other jurisdictions that are relevant to the Canadian context.

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*Healthcare Policy/Politiques de Santé* cherche à rapprocher le monde de la recherche et celui des décideurs en présentant des travaux de recherche, des analyses et des renseignements qui s'adressent aux deux auditoires. Ainsi donc, nos processus rédactionnel et d'examen des manuscrits font intervenir à la fois des chercheurs et des décideurs.

Nous publions des articles savants et des rapports de recherche qui appuient l'élaboration de politiques et le processus décisionnel dans le domaine de la santé et qui abordent des aspects aussi variés que la gouvernance, l'organisation et la prestation des services, le financement et la répartition des ressources. La revue accueille favorablement les articles rédigés par des chercheurs provenant d'un large éventail de disciplines dans les sciences de la santé, les sciences sociales et la gestion, et par des équipes de recherche interdisciplinaires. Nous invitons également les décideurs ou les membres d'équipes formées de chercheurs et de décideurs à nous envoyer des articles qui traitent de l'échange et de l'application des connaissances.

Bien que *Healthcare Policy/Politiques de Santé* encourage l'envoi d'articles ayant un solide fondement théorique et innovateurs sur le plan méthodologique, nous privilégions la recherche appliquée plutôt que les travaux théoriques et l'élaboration de méthodes. La revue veut maintenir une saveur distinctement canadienne en mettant l'accent sur les questions liées aux services et aux politiques de santé au Canada. Nous publions aussi des travaux de recherche et des analyses présentant des comparaisons internationales qui sont pertinentes pour le contexte canadien.

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# Better Primary Healthcare Information for Canada: A Goal within Reach

PRIMARY HEALTHCARE (PHC) IS RECOGNIZED AS AN INTEGRAL COMPONENT of healthcare systems and is fundamental to achieving health goals for populations (Government of Canada 2001; WHO 1978). Nations with well-developed primary care systems have been shown to have lower per capita healthcare costs and better health outcomes (Starfield 2004). In spite of the importance of PHC in the healthcare system, current data sources are inadequate to support policy development, system management and planning (Broemeling, Watson et al. 2009).

Fully developed and well-designed PHC information systems are required if Canadians are to benefit from the “value proposition” offered by effective PHC – better outcomes and integrated care for populations in a cost-effective manner. But can Canadian jurisdictions achieve better PHC information than they have today? Yes – by learning from the studies in this special issue and select Canadian models, as well as by collectively improving PHC information system models such as those found in Australia, the Netherlands, the United States and the United Kingdom. To provide maximum benefits, improved PHC information systems should be designed to be accessible and relevant to health professionals, health system decision-makers and policy makers in a privacy-sensitive manner.

This special issue of *Healthcare Policy/Politiques de Santé* gives readers important new information on what can be done with existing PHC data sources and the requirements for additional data sources and systems to support health system management and policy development. While the title of this special issue, and the papers within it, indicate an emphasis on British Columbia, the majority of the research findings and recommendations are applicable and highly relevant across Canada. With this in mind, individuals and organizations that play a role in PHC delivery, management and policy can learn from and build on the new knowledge put forth by the contributing researchers.

Specifically, this special issue provides a “roadmap” (Watson 2009b) and a results-based logic model (Watson, Broemeling et al. 2009a), both of which can be applied in designing better PHC information systems. These papers are complemented by others focusing on the limited availability of data across Canada for use in PHC performance measurement (Broemeling, Watson et al. 2009) and methods for leveraging existing sources to develop patient (Broemeling, Kerluke et al. 2009) and provider registries (Watson, Peterson et al. 2009). Wong and colleagues (2009) provide an insightful analysis on the supply and distribution of PHC registered nurses in British Columbia. Watson’s (2009b) preface gives additional details about each paper and an integrated

perspective on developing population-based PHC information systems.

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**To provide maximum benefits, improved primary healthcare information systems should be designed to be accessible and relevant to health professionals, health system decision-makers and policy makers in a privacy-sensitive manner.**

The Canadian Institute for Health Information (CIHI) is currently working on a multi-pronged strategy, in collaboration with a broad range of stakeholders and experts, to develop better PHC data sources. Based on information gathered during stakeholder consultations and PHC projects, the following two high-level PHC information needs have been identified:

- How does PHC performance (e.g., access, quality and outcomes) vary across practice models, regions and jurisdictions, and is it changing over time?
- What are the interrelationships between the various elements of PHC (e.g., access and quality), and how do these relationships influence the desired outcomes (e.g., fewer complications among people with diabetes)?

The PHC data required to address these questions need to be collected from the following four domains: (a) patients/populations, (b) clinical information sources (e.g., electronic medical records, chart abstraction, clinical encounter forms), (c) providers and (d) PHC clinics. A comprehensive PHC information system requires data from all four domains, preferably with some data to produce representative estimates for populations and some that are linkable for use in the interrelationships analyses.

When developing PHC data sources and information requirements, it is important to keep in mind that there are several commonalities that can be leveraged to ensure that data sources are useful for multiple users while also minimizing the data-collection burden.

The first commonality is that data and information needs across jurisdictions are quite similar. For example, CIHI’s Pan-Canadian PHC Indicator Development Project,

which included input from experts and decision-makers from multiple levels across the country, identified a common set of PHC indicators believed to be applicable and important across all jurisdictions (CIHI 2006). When deconstructed, these indicators reveal a set of common data elements that are required across the country to support the information needs of jurisdictions and others. This finding is supported by Watson's (2009a) recommendation for a pan-Canadian approach to PHC data development.

The second commonality is that a single, well-designed source of data or information can be used by many different stakeholders for a variety of purposes. For example, data on technical quality-of-care measures, such as HbA1c screening rates for people with diabetes, would be useful to PHC providers wishing to maximize these rates for their patient populations, for health region planners of chronic disease management and for ministries of health interested in knowing the impact of recent policy changes intended to increase these rates.

The third commonality is that the burden of PHC data collection must be minimized. Arguably, one of the reasons that PHC data sources have not developed at the same pace as institution-based information sources is the way in which PHC is delivered and the limited PHC resources available for data collection. The limitations of time and resources to support new or additional PHC data collection are unlikely to change; however, technology and better electronic medical record (EMR) design do offer opportunities to minimize the data-collection burden. A well-designed PHC data-collection system could make use of data already captured for clinical and administrative purposes in PHC settings. For example, as PHC EMRs and related systems (e.g., laboratory data systems) evolve to become more interoperable and broadly used, they also have the potential to become a valuable and efficient new source of relevant PHC data – provided the limited data collected conform to data standards and are accessed and used in an agreed-upon and privacy-sensitive manner. Data from the other three domains require the completion of periodic surveys, but this can also be done using an approach that minimizes the data-collection burden on a sample of health professionals and populations/patients.

This special issue of *Healthcare Policy/Politiques de Santé* contains many relevant research findings that will help inform PHC data development initiatives across Canada. As Canada embraces the transition to an interoperable PHC EMR environment, the goal of more and better PHC information for Canada is definitely within reach. This is an opportunity to be seized, not missed.

GREG WEBSTER

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Canadian Institute for Health Information (CIHI)*

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# Meilleure information sur les soins de santé primaires au Canada : un objectif à portée de main

**L**ES SOINS DE SANTÉ PRIMAIRES (SSP) SONT CONSIDÉRÉS COMME UN ÉLÉMENT intégrant du système de santé et essentiel pour atteindre les objectifs en matière de santé de la population (gouvernement du Canada 2001; OMS 1978). On observe, chez les États qui ont des systèmes de soins primaires bien développés, de moindres coûts de santé par personne et de meilleurs résultats en santé (Starfield 2004). Malgré l'importance des SSP pour les systèmes de santé, les sources de données actuelles sont inadéquates pour appuyer l'élaboration de politiques ou la gestion et la planification des systèmes (Broemeling, Watson et al. 2009).

Des systèmes d'information bien développés et bien conçus sont nécessaires pour tirer avantage de la « proposition de valeur » offerte par les SSP, c'est-à-dire de meilleurs résultats et des soins intégrés, et ce, à coûts économiques. Cependant, les diverses autorités au Canada peuvent-elles obtenir une information encore meilleure? Oui, en tirant leçon des études présentées dans ce numéro spécial et en choisissant les modèles canadiens, ainsi qu'en améliorant collectivement les modèles de systèmes d'information en matière de SSP, tels qu'en Australie, aux Pays-Bas, aux États-Unis et au Royaume-Uni. Pour obtenir davantage de bénéfices, il faut concevoir des systèmes d'information améliorés qui sont accessibles et pertinents pour les professionnels de la santé, pour les décideurs et pour les responsables de politiques, tout en respectant le caractère confidentiel de l'information.

Le présent numéro spécial de *Politiques de santé/Healthcare Policy* offre aux lecteurs d'importants renseignements sur ce qu'on peut accomplir avec les sources de données actuelles et expose les besoins en matière de sources ou systèmes de données supplémentaires afin d'appuyer la gestion du système de santé et l'élaboration de politiques. Bien que le titre du numéro spécial et les articles qui s'y trouvent portent essentiellement sur la Colombie-Britannique, la plupart des conclusions et des recommandations qu'il présente sont très pertinents et s'appliquent partout au Canada. Les personnes et les organismes

qui jouent un rôle dans la prestation, la gestion ou les politiques liées aux SSP peuvent utiliser ces nouvelles connaissances mises à leur disposition par les chercheurs.

Ce numéro spécial présente, en particulier, une « feuille de route » (Watson 2009b) et un modèle logique axé sur les résultats (Watson, Broemeling et al. 2009), qui tous deux peuvent servir à la conception de meilleurs systèmes d'information sur les SSP. D'autres articles du numéro portent sur l'accessibilité limitée, au Canada, des sources de données pour les mesures du rendement en matière de SSP (Broemeling, Watson et al. 2009) ainsi que sur les méthodes pour développer, à partir des sources de données actuelles, des registres sur les patients (Broemeling, Kerluke et al. 2009) et sur les prestataires de services (Watson, Peterson et al. 2009). Wong et ses collègues (2009) offrent une analyse instructive sur l'effectif et la distribution des infirmières autorisées qui travaillent dans le secteur des SSP en Colombie-Britannique. La préface de Watson (2009b) présente des renseignements supplémentaires sur chacun des articles et donne un point de vue global pour l'élaboration de systèmes d'information démographiques pour les SSP.

L'Institut canadien d'information sur la santé (ICIS) élabore présentement une stratégie concertée, avec la participation de plusieurs partenaires et experts, pour la conception de meilleures sources de données sur les SSP. À la lumière des informations recueillies au cours de projets sur les SSP et par consultation auprès des parties prenantes, l'ICIS a dégager les deux principaux besoins en information sur les SSP suivants :

- Quelle est la variation du rendement en matière de SSP entre les modèles de pratique, les régions et les autorités compétentes (par exemple, l'accès, la qualité des services et les résultats)? Cette variation change-t-elle au fil du temps?
- Quelles sont les relations entre les divers éléments des SSP (par exemple, entre accès et qualité) et comment ces relations influencent-elles les résultats souhaités (par exemple, réduction des complications pour les personnes atteintes de diabète)?

Pour traiter ces questions, il faut recueillir des données sur les SSP dans les quatre domaines suivants : (a) patients et populations, (b) sources d'information clinique (par exemple, dossiers médicaux informatisés, élaboration de schémas, modes de visites en clinique), (c) prestataires et (d) cliniques de SSP. Un système d'information complète sur les SSP doit contenir des données sur ces quatre domaines avec, préférablement, certaines données permettant d'effectuer des estimations représentatives pour les populations et certaines données qui puissent être liées entre elles pour effectuer des analyses de relations.

Dans le développement des sources de données et des besoins en information pour les SSP, il faut garder en tête que plusieurs aspects communs peuvent être

exploités afin d'assurer que les sources de données soient utiles tout en minimisant le fardeau de la collecte.

Le premier aspect commun est que les données et les besoins en information sont sensiblement les mêmes d'un endroit à l'autre. Par exemple, le Projet d'élaboration d'indicateurs pancanadiens de soins de santé primaires de l'ICIS, lequel tient compte de l'apport d'experts et de décideurs de divers niveaux partout au pays, a permis de dégager un ensemble commun d'indicateurs importants qui peuvent s'appliquer auprès de toute autorité compétente (ICIS 2006). Après analyse, ces facteurs révèlent un ensemble commun d'éléments de données qui sont nécessaires partout au pays pour appuyer les besoins en information des diverses autorités ou autres. La recommandation de Watson (2009a) en faveur d'une démarche pancanadienne pour le développement de données vient appuyer cette conclusion.

Le deuxième aspect commun est qu'une source de données unique et bien conçue peut être utilisée par plusieurs parties prenantes, et ce, pour une variété d'activités. Par exemple, les données sur les mesures techniques pour la qualité des soins, tels que les taux de dépistage de l'HbA1c pour les personnes atteintes de diabète, peuvent être utiles aux prestataires de SSP qui désirent maximiser ces taux chez les populations de patients, peuvent servir aux planificateurs régionaux pour la gestion des maladies chroniques, ou encore, aux ministres de la Santé qui veulent connaître l'impact d'ajustements politiques visant l'augmentation de ces taux.

Le troisième aspect commun a trait au fardeau lié à la collecte de données. Il est permis de croire qu'une des raisons pour laquelle les sources de données sur les SSP n'ont pas évolué aussi rapidement que les sources d'information institutionnelles est le mode même de prestation des SSP et le peu de ressources disponibles pour la collecte. Les limites de temps et de ressources pour effectuer de nouvelles collectes de données sont peu susceptibles de s'améliorer, cependant, la technologie et une meilleure conception des dossiers médicaux informatisés (DMI) offrent la possibilité de minimiser le fardeau lié à la collecte de données. Un système de collecte bien conçu peut permettre de tirer profit des données qui sont déjà disponibles, pour des raisons cliniques ou administratives, dans les établissements de SSP. Par exemple, les DMI dans les SSP et les systèmes connexes (par exemple, les systèmes d'information de laboratoire) deviennent de plus en plus interexploitables et offrent, par surcroît, la possibilité de devenir une précieuse source de données pertinentes pour les SSP – dans la mesure où les données recueillies sont conformes aux normes et utilisées dans le respect de la confidentialité. Dans les trois autres domaines, les données dépendent de sondages effectués périodiquement, mais cela peut se faire en se limitant à un échantillon de patients ou de professionnels de la santé, minimisant ainsi le fardeau lié à la collecte.

Ce numéro spécial de *Politiques de Santé/Healthcare Policy* présente plusieurs conclusions de recherche pertinentes, lesquelles renseigneront les initiatives de développement de données sur les SSP au Canada. Alors que le Canada procède présente-

ment à une transition vers un environnement interexploitable de DMI dans les SSP, l'information sur les SSP est sans conteste un objectif à portée de main, au pays. Il s'agit là d'une occasion qu'il ne faut surtout pas laisser passer.

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# The Development of a Primary Healthcare Information System to Support Performance Measurement and Research in British Columbia

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**I**N 2003, THE BRITISH COLUMBIA MINISTRY OF HEALTH SERVICES CONTRACTED with the Centre for Health Services and Policy Research at the University of British Columbia to conduct three years of work to establish a population-based information system to describe the primary healthcare (PHC) sector from temporal, geographic, population and provider perspectives. In this special issue of *Healthcare Policy/Politiques de Santé*, we share lessons from that experience for those interested in conducting similar work, and point readers to other reports that have emerged from these undertakings. This information will be of interest to healthcare policy makers and managers, as we describe key challenges and opportunities in developing information systems designed to support performance management and research in this sector. The topic is timely, given the importance that Canadians attribute to PHC and the magnitude of public investments over the past decade to improve PHC performance.

## Why Focus on the PHC Sector?

Canadians are increasingly concerned about access to and quality of PHC, and they hold specific expectations about the importance of this sector, the type of renewal they want and the need for public reporting on progress (Watson and Krueger 2005). For instance, when asked in 2002 to deliberate about various options to sustain their healthcare system, Canadians recommended multidisciplinary PHC teams that would be supported by a central information system to provide more coordinated care and relieve family physicians of current workload burdens (Maxwell et al. 2002). In that same year, 80% of Canadians reported that more spending on “new, more efficient methods for providing PHC” should be a top or important priority among the nation’s leaders. Canadians also want to learn about progress – in 2000 and 2003, approximately 45% reported that they were somewhat or very dissatisfied with the level of public reporting regarding healthcare system performance (Soroka 2007).

In response, the prime minister and premiers (“First Ministers”) made commitments in 2003 to a Health Accord, and in 2004 to a 10-Year Plan to Strengthen Health Care in Canada in order to renew PHC and enhance accountability and transparency (Government of Canada 2003, 2004). These investments were additional to multi-year investments that commenced in 2000 to catalyze renewal through the Primary Health Care Transition Fund (Government of Canada 2000). All federal, provincial and territorial governments now invest in renewal initiatives designed to improve the organization, funding and delivery of these services. Some jurisdictions report to their citizens on an annual basis, while others do not (Health Council of Canada 2007).

It is possible to use case studies, project evaluations and anecdotal evidence to inform quality improvement of local services. But population-based information systems that generate relevant information are needed to enable the healthcare policy and management communities to monitor the performance of this sector at regional levels, identify areas requiring attention and action, assess the relative impact of different strategies to catalyze system renewal and account to citizens on progress. This type of system stores information about all events experienced by a population, as recorded and measured using administrative data encompassing all encounters (e.g., payments by governments to remunerate doctors) or through deliberate sampling strategies that ensure data are representative of populations (e.g., patient or provider surveys).

Today, few jurisdictions in Canada have developed a population-based PHC information system for routine use. A number of jurisdictions, such as British Columbia, Manitoba and Ontario, have undertaken work to develop and validate information systems, particularly regarding the use of administrative data relevant to payments by governments to remunerate doctors. Other jurisdictions and organizations have conducted population-based surveys of providers, citizens or both. However, these systems aren’t routinely used for performance management to improve quality or for accountability via routine and comprehensive public reporting.

Although initiatives are underway across the country to develop electronic information systems to support clinical care (e.g., disease registries, medical records and reminder systems), only 23% of primary care doctors in Canada reported that they had these systems in their office in 2006 (Schoen et al. 2006). Even if these systems were in place, they would be unlikely to offer the array of information required by the healthcare policy and management communities. Other information systems are needed, for example, to understand and better plan for the future supply of health human resources. In fact, even if administrative data on clinical and health human resources were in place, other information systems are needed to understand and better plan to improve patients' experiences with care and providers' experiences at work. While initiatives are underway to survey nurses, for example, the information collected has not been prospectively defined as a priority vis-à-vis the performance of the PHC sector, nor collected to represent providers that deliver this type of care.

## What Lessons Does the BC Experience Hold for Others?

Our vision is to ensure that healthcare policy makers and managers receive relevant, valid and timely information about the PHC sector that is useful to them in assuming their accountability and decision-making responsibilities. The steps that we undertook to design an information system – one that is data-based and can be used to monitor PHC performance at regional levels and across time – identify areas requiring attention and action, assess the relative impact of different strategies to catalyze system renewal and account to citizens on progress, using robust principles for organizing data (summarized in Figure 1). The papers in this special issue document lessons learned at each step. A glossary at the end of this preface defines many of the terms

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**Our vision is to ensure that healthcare policy makers and managers receive relevant, valid and timely information about the primary healthcare sector that is useful to them in assuming their accountability and decision-making responsibilities.**

describes work conducted to create a performance measurement and accountability framework for this sector. We used the approach of the Treasury Board of Canada in designing performance measurement and accountability frameworks, beginning with

used throughout the special issue to ensure specificity in meaning when communicating complex or nuanced issues. Our website contains information generated using our population-based information system ([www.chspr.ubc.ca](http://www.chspr.ubc.ca)).

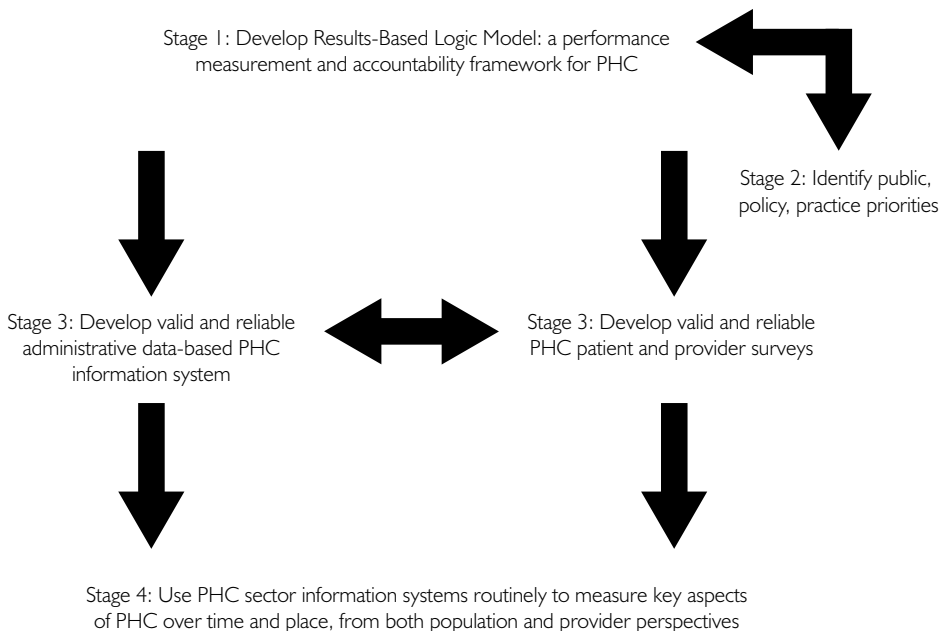
The first paper, "A Results-Based Logic Model for Primary Healthcare: A Conceptual Foundation for Population-Based Information Systems" (Watson, Broemeling et al.)

## The Development of a Primary Healthcare Information System to Support Performance Measurement and Research in British Columbia

the creation of a results-based logic model. This was done through completion of a policy analysis regarding important objectives, processes and outcomes expected of PHC, a literature review regarding the important dimensions of PHC services and broad consultation regarding presumed linkages between PHC inputs, activities, outputs and outcomes.

The next challenge was to define priorities for information on the PHC sector among healthcare policy, management and practice communities, as well as the public, so that data development and collection strategies aligned with those needs. Thus, this first paper also describes initiatives in British Columbia and elsewhere in Canada using our logic model to identify priorities among the policy and management communities.

**FIGURE 1.** Steps taken to develop a population-based PHC information system in British Columbia to support routine use of information for performance measurement and research



Although the creation of information systems to support performance measurement and research was needed to leverage current measurement, monitoring and reporting efforts, also required was new architecture to fill information gaps in priority areas. In order to assist ongoing work in identifying potential indicators that could be measured using existing population data, the authors of the second paper, "Measuring the Performance of Primary Healthcare: Existing Capacity and Potential Information to Support Population-Based Analyses" (Broemeling, Watson et al.) identify an array of existing population-based administrative and survey data sources and highlight gaps in current information. Our logic model was used as the conceptual framework, and

clearly highlighted gaps that must be addressed to enable comprehensive performance measurement, research, accountability and public reporting.

In response to growing concerns regarding the completeness and accuracy of fee-for-service (FFS) administrative data in measuring the performance of the PHC sector in terms of physician services, we spent considerable time between 2003 and 2006 further developing the administrative data holdings at the CHSPR at the University of British Columbia.

The jurisdictions most notable for developing and using population-based administrative data relevant to PHC rely principally on FFS and shadow billing payment files. In British Columbia, there has been a decline in the proportion of total payments to physicians via FFS, and no form of shadow billing identifies information on provider–patient encounters. More recently, the validity of analyses based solely on FFS payment files has come into question, in terms of completeness and therefore accuracy, with the growth in alternative funding of physicians. No uniform nationwide standards exist to guide the establishment of databases designed to track those payments and to support pooling of data from FFS and alternative funding sources. As the size of alternative funding for physician services grows in Canada, the usefulness of FFS payment data as a sole source of population-based information describing encounters between patients and physicians will erode. Therefore, a number of papers in this special supplement address the designing of information systems within this evolving environment and highlight the importance of design for future information needs.

In order to support the development and use of administrative data for measuring and tracking supply and use of health services by the public and special populations, valid population-based registries are needed. Challenges exist in the creation of registries when provincial ministries of health, such as the one in British Columbia, charge monthly fees for enrolment in the Medical Services Plan, and when patients receive services from PHC organizations that aren't required to submit patient identifiers to receive remuneration. The calculation of population-based rates should include all users and non-users, irrespective of enrolment status. A further critical challenge is that of maintaining privacy and security of confidential, individual-level information. Thus, Broemeling, Kerluke and colleagues ("Developing and Maintaining a Population Research Registry to Support Primary Healthcare Research") describe work undertaken to develop and validate a population registry of residents irrespective of their enrolment status with the BC Ministry of Health and identify special populations for cohort analyses.

Because family physicians are increasingly remunerated through alternative funding mechanisms such as capitation or block funding to group practice organizations, it is increasingly necessary to count the size of the clinical workforce and describe their patterns of practice using databases other than FFS payment files. Watson, Peterson and colleagues ("Methods to Develop and Maintain a Valid Physician Registry in

Evolving Information Environments”) describe new methods to develop and validate an anonymous registry of the physician workforce (general practitioners, family physicians and specialists) to support analyses in environments where doctors are increasingly funded through diverse arrangements.

One of the key policy objectives of renewal efforts in Canada is the inclusion of nurses in PHC teams. Because PHC is defined by service attributes, the challenge is to identify and track physicians and nurses who deliver these services. In “Supply and Distribution of Primary Healthcare Registered Nurses in British Columbia,” Wong and colleagues describe new methods developed to classify nurses using self-reported data from the College of Registered Nurses of British Columbia. The authors assess geographic patterns of supply of these nurses relative to PHC physicians and to the health of populations. Other reports by our team describe methods to identify and track PHC who are registered as family physicians, general practitioners or specialists (Watson, Black et al. 2006) and to identify and track shifts in single and group practices among this workforce (McKendry, Watson et al. 2006).

Quality improvement and public reporting activities require routine use of PHC information systems to measure key aspects of care over time and place, from both population and provider perspectives. Yet, the degree to which these activities are conducted depends critically on sustained demand for information about healthcare from citizens and a commitment from healthcare policy makers and administrators to deliver it.

Routine public reporting is also critically dependent on sustained fiscal investments as well as the supply of highly trained research, analytical and communications staff. Internationally, Canadian policy makers and researchers have partnered to be leaders in the development and use of administrative data to describe the supply, distribution and use of physicians and their services. But these systems are in their infancy vis-à-vis the PHC sector, and little work has been done to support survey information systems for PHC.

Thus, the concluding paper, “For Discussion: A Roadmap for Population-Based Information Systems to Enhance Primary Healthcare in Canada” (Watson) summarizes lessons learned from the BC experience and offers advice to inform work to expand population-based information systems across Canada intended to support PHC renewal. A roadmap of options for new information systems is sketched and the opportunities and limitations associated with each are described. The intent is to offer an array of alternatives, since jurisdictions vary in their vision and objectives for renewal and priorities for information. The author concludes with general recommendations to improve the situation so that governments and researchers are better able to monitor the PHC sector and report to Canadians about investments designed to enhance patient experiences with PHC and the health outcomes that emerge from these public investments.

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# Création d'un système d'information pour les soins de santé primaires afin d'appuyer la mesure du rendement et la recherche en Colombie-Britannique

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EN 2003, LE MINISTÈRE DES SERVICES DE SANTÉ DE LA COLOMBIE-Britannique confiait au Centre de recherche sur les services et les politiques de santé (*Centre for Health Services and Policy Research, CHSPR*) de l'Université de la Colombie-Britannique le développement, sur une période de trois ans, d'un système d'information démographique visant à décrire le secteur des soins de santé primaires (SSP) de façon chronologique et géographique ainsi que du point de vue de la population et des prestataires de services. Ce numéro spécial de *Politiques de Santé/Healthcare Policy* présente les leçons tirées de cette expérience à ceux qui souhaitent entreprendre un tel travail, et propose aux lecteurs d'autres rapports qui découlent de cette entreprise. Cette information est d'intérêt pour les gestionnaires et les responsables des politiques de santé, car elle présente les principales possibilités et les défis clés liés à la création de systèmes d'information conçus pour appuyer la gestion du rendement et la recherche dans ce secteur. Le sujet est à propos, étant donné l'importance attribuée par les Canadiens aux SSP et l'ampleur des fonds publics investis dans l'amélioration des SSP au cours de la dernière décennie.

## Pourquoi s'intéresser au secteur des SSP?

Les Canadiens sont de plus en plus intéressés par l'accès aux SSP et par leur qualité. Ils ont des attentes précises quant à l'importance de ce secteur, quant au type de restructuration désirée et quant au besoin d'une diffusion publique des progrès réalisés (Watson et Krueger 2005). Par exemple, au cours des délibérations de 2002 au sujet des divers choix pour la viabilité du système de santé, les Canadiens ont recommandé la mise en place d'équipes multidisciplinaires de SSP appuyées par un système d'information central afin d'assurer une meilleure coordination des soins et d'alléger la charge de travail des médecins de famille (Maxwell et al. 2002). Au cours de la même année, 80 % des Canadiens ont indiqué que des dépenses accrues pour de « nouvelles méthodes plus efficaces d'offrir les SSP » devraient constituer une priorité de première importance pour les dirigeants nationaux. Les Canadiens veulent également en savoir davantage sur les progrès accomplis : en 2002 et en 2003, environ 45 % d'entre eux ont signalé être assez ou très insatisfaits du niveau de diffusion publique d'information quant au rendement du système de santé (Soroka 2007).

À titre de réponse, les premiers ministres fédéral et provinciaux se sont engagés, en 2003, à un Accord sur le renouvellement des soins de santé et, en 2004, à un Plan décennal pour consolider les soins de santé afin de restructurer les SSP et d'en améliorer la responsabilité et la transparence (gouvernement du Canada 2003, 2004). Ces engagements s'ajoutaient à des investissements échelonnés sur plusieurs années qui ont débuté en 2000 afin de catalyser la restructuration par le biais du Fonds pour l'adaptation des soins de santé primaires (gouvernement du Canada 2000). Les autorités fédérale, provinciales et territoriales investissent toutes actuellement dans des initiatives de restructuration conçues pour améliorer l'organisation, le financement et la prestation de ces services. Certaines d'entre elles font rapport annuellement auprès de leurs citoyens, d'autres non (Conseil canadien de la santé 2007).

Les études de cas, les évaluations de projets et les données anecdotiques peuvent renseigner sur l'amélioration de la qualité des services locaux. Mais les systèmes d'information démographique qui fournissent une information pertinente restent nécessaires pour permettre aux milieux des politiques et de la gestion de la santé de surveiller, au niveau régional, le rendement de ce secteur, de déceler les endroits où une attention particulière et une action sont nécessaires, d'évaluer l'impact relatif des diverses stratégies visant la réforme du système et de rendre compte, auprès des citoyens, des progrès réalisés. Ce genre de système recueille des renseignements sur toutes les activités vécues par une population, consignées et mesurées au moyen de données administratives qui incluent toute activité (par exemple, les paiements gouvernementaux pour la rémunération des médecins) ou par des stratégies d'échantillonnage qui assurent que les données sont bien représentatives de la population (par exemple, des sondages auprès des patients ou des prestataires de services).

Présentement, peu de gouvernements ont mis en place, au Canada, un système

d'information démographique à usage routinier. Certains d'entre eux, tels que la Colombie-Britannique, le Manitoba et l'Ontario, ont entrepris le développement et la validation de systèmes d'information, en particulier pour ce qui a trait à l'utilisation des données administratives touchant aux paiements gouvernementaux pour la rémunération des médecins. D'autres gouvernements et organismes ont mené des sondages auprès des prestataires de services, des citoyens, ou des deux à la fois. Cependant, ces systèmes ne sont pas utilisés de façon routinière dans la gestion du rendement pour améliorer la qualité ou pour satisfaire les exigences d'obligation redditionnelle au moyen d'une diffusion périodique et complète de l'information auprès du public.

Bien que, partout au pays, il y ait des initiatives pour créer des systèmes électroniques d'information en appui aux soins cliniques (par exemple, les registres pour les maladies, les dossiers médicaux et les systèmes de rappel), en 2006, seulement 23 % des médecins de première ligne au Canada indiquaient avoir de tels systèmes dans leur cabinet (Schoen et al. 2006). Et lorsqu'ils étaient en place, il était peu probable que ces systèmes fournissent l'éventail de renseignements nécessaires pour les milieux de la gestion et des politiques de la santé. D'autres systèmes d'information sont nécessaires, par exemple, pour mieux comprendre et planifier l'avenir des ressources humaines de la santé. En fait, même si les données administratives sur les ressources cliniques et les ressources humaines sont disponibles, il faut également connaître d'autres types de renseignements pour mieux comprendre et améliorer l'expérience des patients avec les services et l'expérience de la main-d'œuvre en milieu de travail. Bien qu'il y ait des sondages pour interroger les infirmières, par exemple, les renseignements recueillis n'ont pas été éventuellement désignés comme prioritaires face au rendement du secteur des SSP, et n'ont pas non plus été recueillis de façon à représenter les prestataires de première ligne.

## Quelles leçons peut-on tirer de l'expérience de la Colombie-Britannique?

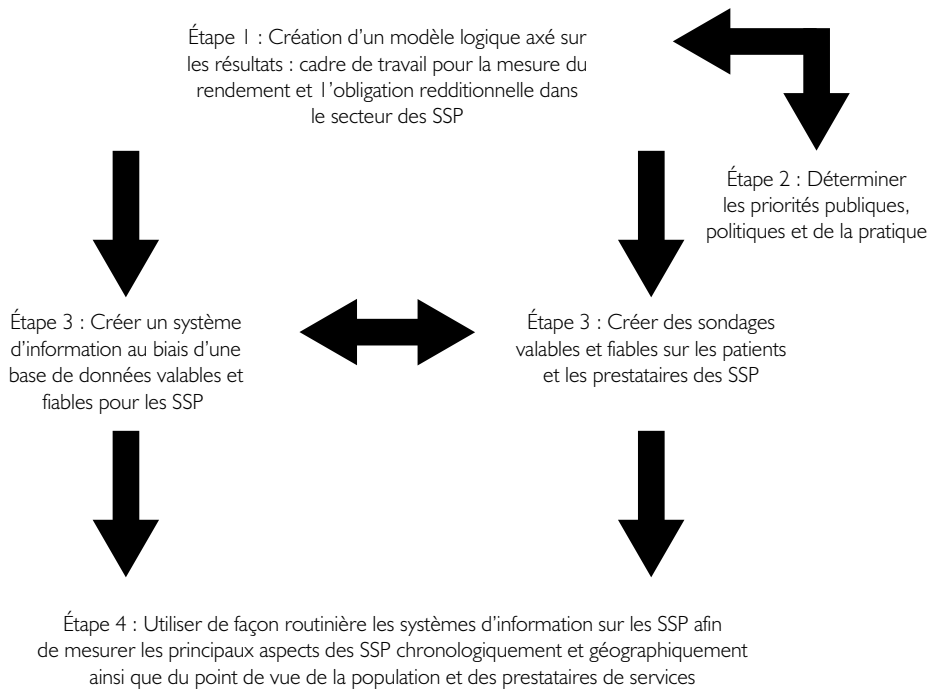
Notre vision est d'assurer que les responsables de politiques et les gestionnaires de la santé aient accès à une information pertinente, valable et actuelle qui soit utile pour l'exercice de leurs responsabilités en termes de décision et d'obligation redditionnelle. Le travail que nous avons entrepris pour la conception d'un système d'information – qui fonctionne comme base de données et qui puisse être utilisé pour surveiller le rendement des SSP au niveau régional et

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Notre vision est d'assurer que les responsables de politiques et les gestionnaires de la santé aient accès à une information pertinente, valable et actuelle qui soit utile pour l'exercice de leurs responsabilités en termes de décision et d'obligation redditionnelle.

au fil du temps – détermine les endroits où une attention particulière et une action sont nécessaires, permet d'évaluer l'impact relatif des diverses stratégies visant la réforme du système et permet de rendre compte, auprès des citoyens, des progrès réalisés, au moyen de principes de base d'organisation des données (résumés dans la figure 1). Les articles de ce numéro spécial documentent les leçons tirées de chaque étape du travail. Le glossaire qui suit définit plusieurs termes utilisés dans le numéro spécial afin de préciser la signification d'enjeux complexes ou nuancés. Notre site Web présente l'information tirée de notre système d'information démographique ([www.chspr.ubc.ca](http://www.chspr.ubc.ca)).

**FIGURE 1.** Étapes pour la création d'un système d'information démographique pour les SSP en Colombie-Britannique afin de favoriser l'usage routinier de l'information pour la mesure du rendement, l'obligation redditionnelle et la recherche



Le premier article, « Modèle logique axé sur les résultats pour les soins de santé primaires : fondement conceptuel pour les systèmes d'information démographique » (Watson, Broemeling et al.) décrit le travail accompli pour créer un cadre de mesure du rendement et d'obligation redditionnelle pour ce secteur. Nous nous sommes inspirés de la démarche du Conseil du Trésor du Canada pour la conception de cadres de travail pour la mesure du rendement et l'obligation redditionnelle, en commençant par la création d'un modèle logique axé sur les résultats. Pour y parvenir, nous avons procédé à une analyse des politiques touchant d'importants objectifs, processus et

résultats escomptés pour les SSP. Nous avons également effectué une revue de la littérature sur les principaux aspects des services de SSP ainsi qu'une vaste consultation sur les liens potentiels entre les intrants, les activités, les extrants et les résultats dans le contexte des SSP.

Le défi suivant consistait à définir les priorités en matière d'information sur le secteur des SSP pour les milieux des politiques, de la gestion et de la pratique, de même que pour le grand public, de sorte que les stratégies pour le traitement des données s'harmonisent aux besoins. Ce premier article décrit également des initiatives entreprises en Colombie-Britannique et ailleurs au Canada en employant notre modèle logique afin de déterminer les priorités au sein des milieux des politiques et de la gestion.

Bien qu'il soit nécessaire de créer des systèmes d'information pour appuyer la mesure du rendement et la recherche essentielles aux efforts actuels en matière de mesure, de surveillance et de diffusion, il est également nécessaire de concevoir une nouvelle structure permettant de combler les lacunes en matière d'information dans les domaines prioritaires. Afin d'appuyer le travail en cours pour déterminer les indicateurs potentiels qui peuvent être mesurés au moyen des données démographiques disponibles, les auteurs du deuxième article, « Mesure du rendement en matière de soins de santé primaires : capacité actuelle et information potentielle pour les analyses fondées sur la population » (Broemeling, Watson et al.) ont recensé une série de sources de données démographiques administratives ou issues de sondages et ont souligné les lacunes de l'information actuelle. Nous avons employé notre modèle logique comme cadre conceptuel, ce qui a clairement permis de souligner les lacunes à traiter afin de permettre, de façon complète, la mesure du rendement, la recherche, l'obligation redditionnelle et la diffusion publique d'information.

En réponse aux préoccupations grandissantes au sujet de l'exhaustivité et de la précision des données administratives sur la rémunération à l'acte (RAA), pour la mesure du rendement du secteur des SSP en termes de services offerts par les médecins, nous avons consacré beaucoup de temps entre 2003 et 2006 à développer davantage le fonds de données administratives au CHSPR de l'Université de la Colombie-Britannique.

Les autorités qui se démarquent dans le développement et l'utilisation des données administratives démographiques pertinentes aux SSP comptent principalement sur les fichiers des paiements liés à la RAA et à la facturation pro forma. En Colombie-Britannique, la proportion totale des paiements versés aux médecins au moyen de la RAA a connu un déclin; par ailleurs, aucune forme de facturation pro forma ne permet de retracer l'information sur les rencontres entre prestataires et patients. Plus récemment, on a remis en question, en termes d'exhaustivité et de précision, la validité des analyses fondées uniquement sur les fichiers des paiements liés à la RAA, étant donné la croissance des autres modes de financement pour les médecins. Il n'existe aucune norme uniforme nationale pour guider la mise en place de bases de données conçues de façon à retracer ces modes de rémunération et de façon à permettre la mise

en commun des données provenant des sources liées à la RAA et aux autres modes de financement. Puisque les modes de financement pour les services médicaux se diversifient au Canada, la pertinence des données sur la RAA, comme source unique d'information démographique décrivant les rencontres entre patients et médecins, perd en importance. Ainsi, certains articles de ce numéro traitent de la conception de systèmes d'information dans ce contexte changeant et soulignent l'importance de tenir compte des besoins à venir en matière d'information.

Afin d'appuyer le traitement et l'utilisation des données administratives pour la mesure et le suivi de la prestation et de l'utilisation des services de santé par le public et les groupes spéciaux de la population, il est nécessaire d'avoir des registres démographiques valides. La création de registres pose des défis quand les ministres de la Santé, comme celui de la Colombie-Britannique, imposent des frais mensuels pour l'inscription au régime de soins médicaux et quand les patients reçoivent des services auprès d'organismes de soins de santé primaires qui n'ont pas l'obligation de présenter l'identité des patients pour percevoir la rémunération. Le calcul des taux fondés sur la population devrait tenir compte des usagers comme des non usagers, indépendamment du statut de leur inscription. Un autre défi de taille repose dans la question de la confidentialité des renseignements touchant les individus. À cet effet, Broemeling, Kerluke et leurs collègues (« Création et maintien d'un registre démographique pour la recherche sur les soins de santé primaires ») présentent le travail entrepris pour créer et valider un registre de la population résidente indépendamment du statut d'inscription auprès du ministère de la Santé britanno-colombien, et décrivent des groupes spéciaux de la population pour des analyses par cohortes.

Étant donné que les médecins de famille sont de plus en plus rémunérés par le biais d'autres modes de financement, tels que la capitation ou le financement global des organismes de médecine de groupe, il est davantage nécessaire de recenser l'effectif clinique et de décrire ses modèles de pratique au moyen de bases de données autres que celles provenant des fichiers de paiements pour la RAA. Watson, Peterson et leurs collègues (« Méthodes pour la création et le maintien d'un registre de médecins dans le contexte évolutif de l'information ») décrivent de nouvelles méthodes pour créer et valider un registre anonyme de l'effectif des médecins (omnipraticiens, médecins de famille et spécialistes), afin de permettre des analyses dans un contexte où la rémunération des médecins prend des formes de plus en plus diverses.

Un des principaux objectifs politiques des efforts de restructuration au Canada est l'inclusion des infirmières dans les équipes de SSP. Puisque les SSP sont définis par la nature des services, le défi consiste à identifier et à retracer les médecins et les infirmières qui les fournissent. Dans l'article « Effectif et distribution des infirmières autorisées œuvrant dans les soins primaires en Colombie-Britannique », Wong et ses collègues décrivent de nouvelles méthodes pour classifier les infirmières selon les données volontairement fournies par ces dernières au Collège des infirmières autorisées de

la Colombie-Britannique. Les auteures évaluent les modèles géographiques de la distribution des infirmières en fonction des médecins de première ligne et de l'état de santé de la population. D'autres rapports rédigés par notre équipe décrivent des méthodes pour identifier et retracer les médecins de premières ligne qui sont inscrits comme médecins de famille, omnipraticiens ou spécialistes (Watson, Black et al. 2006) et pour identifier et retracer les mouvements chez les individus ou groupes de pratique au sein de cette main-d'œuvre (McKendry, Watson et al. 2006).

L'amélioration de la qualité et la diffusion publique d'information demandent un usage routinier des systèmes d'information sur les SSP afin de mesurer les principaux aspects des soins sur une période de temps et en un lieu donné, tant du point de vue de la population que de celui des prestataires de services. Néanmoins, la réalisation de ces activités dépend fortement d'une demande continue d'information de la part des citoyens et d'un engagement de la part des administrateurs et des responsables des politiques de santé pour la diffuser.

La diffusion publique d'information dépend fortement d'un investissement financier soutenu ainsi que de la participation de spécialistes hautement formés en recherche, en analyse et en communication. À l'échelle internationale, les chercheurs et les responsables de politiques canadiens ont joué un rôle de leaders dans le développement et l'utilisation de données administratives afin de décrire l'effectif et la distribution des médecins ainsi que l'usage de leurs services. Cependant, ces systèmes n'en sont qu'à leur début dans le contexte des SSP, et peu de choses ont été faites pour appuyer les systèmes d'information par sondage.

Ainsi, l'article qui conclut le numéro spécial, « Pour discussion : feuille de route pour les systèmes d'information démographique afin de renforcer les soins de santé primaires au Canada » (Watson, 2009), résume les leçons apprises de l'expérience de la Colombie-Britannique et offre des conseils pour le développement de systèmes d'information démographique dans tout le Canada afin d'appuyer la restructuration des soins de santé primaires. 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. L'auteure conclut par des recommandations générales pour améliorer la situation de sorte que les gouvernements et les chercheurs soient plus en mesure de surveiller le secteur des SSP et de faire rapport, auprès des Canadiens, sur les investissements visant l'amélioration de l'expérience des patients et sur les résultats pour la santé.

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# Summary of Terms

**Alternative funding:** “Methods other than fee-for-service used to fund clinical departments (e.g., practice plans or academic medical centres) or specific programs. The agency that receives the funding is responsible for determining the nature and amount of payment to individual physicians.” (CIHI 2006)

**Block funding:** Annual budgets negotiated for a group of physicians, usually associated with an academic medical centre. (CIHI 2006)

**Capitation:** Funding provided to an organization, usually a group of healthcare providers, as an amount per patient to provide a defined set of services to a defined population for a defined period of time.

**Payment file:** Electronic information system that records payments made by funding bodies such as ministries of health to individual providers or provider organizations. These are of two types: FFS payment data and alternative payment data.

**Registration file:** Electronic information system that includes data about people but not services or payments.

**Services file:** Electronic information system that records services delivered or received, but does not include information regarding remuneration or payment. An example is a Hospital Discharge Abstract Database or the electronic databases used by primary healthcare organizations.

**Shadow billing:** The practice of using a payment file to collect electronic data regarding services but not using these data for the purpose of calculating payments. This practice occurs in provinces that have elected, for example, to have salaried physicians submit FFS claims to record the services they deliver. These FFS claims are not paid, but the data are used simply to monitor service delivery.

# Sommaire des termes

**Autres modes de financement :** « Méthodes autres que la rémunération à l'acte utilisées pour financer les services cliniques (par exemple, les plans de pratique ou les centres médicaux universitaires) ou les programmes particuliers. L'agence qui reçoit le financement doit déterminer le genre de paiement et la somme remise aux médecins individuels. » (ICIS 2006)

**Capitation :** Financement accordé à un organisme, habituellement un groupe de prestataires de services de santé, à titre de montant par patient pour offrir un ensemble de services définis à une population définie pour une période de temps définie.

**Dossier d'inscription :** Système d'information électronique qui contient des données sur les personnes, mais non sur les services ou les paiements.

**Dossier des services :** Système d'information électronique qui contient les services fournis ou reçus, mais qui ne contient pas d'information sur la rémunération ou les paiements. À titre d'exemple : la base de données du registre des sorties des hôpitaux ou les bases de données électroniques utilisées par les organismes de soins de santé primaires.

**Facturation pro forma :** L'emploi d'un fichier des paiements pour recueillir des données électroniques sur les services, mais sans utiliser ces données pour calculer les paiements. Cette pratique a lieu dans les provinces qui ont choisi, par exemple, de demander aux médecins salariés de présenter des réclamations pour la rémunération à l'acte afin de documenter les services qu'ils offrent. Les réclamations pour la rémunération à l'acte ne sont pas payées, mais les données sont utilisées pour surveiller la prestation des services.

**Fichier des paiements :** Système d'information électronique qui contient les paiements effectués par les organismes de financement, tels que les ministères de la Santé, à faveur de prestataires individuels ou d'organismes de services. Il y a deux types de données : celles concernant la rémunération à l'acte et celles concernant les autres modes de financement.

**Financement global :** Budgets annuels négociés pour un groupe de médecins; généralement associé à un centre médical universitaire. (ICIS 2006)

# A Results-Based Logic Model for Primary Healthcare: A Conceptual Foundation for Population-Based Information Systems

Modèle logique axé sur les résultats pour les soins de santé primaires : fondement conceptuel pour les systèmes d'information démographique



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## Abstract

A conceptual framework for population-based information systems is needed if these data are to be created and used to generate information to support healthcare policy, management and practice communities that seek to improve quality and account for progress in primary healthcare (PHC) renewal. This paper describes work conducted in British Columbia since 2003 to (1) create a Results-Based Logic Model for PHC using the approach of the Treasury Board of Canada in designing management and accountability frameworks, together with a literature review, policy analysis and broad consultation with approximately 650 people, (2) identify priorities for information within that logic model, (3) use the logic model and priorities within it to implement performance measurement and research and (4) identify how information systems need to be structured to assess the impact of variation or change in PHC inputs, activities and outputs on patient, population and healthcare system outcomes. The resulting logic model distinguishes among outcomes for which the PHC sector should be held more or less accountable.

## Résumé

Un cadre conceptuel pour la mise en place de systèmes d'information démographique, qui permettent de traiter les données et de fournir l'information nécessaire, est essentiel pour les milieux de la gestion, de la pratique et des politiques en matière de santé qui souhaitent améliorer la qualité des services et rendre compte des progrès réalisés dans le cadre de la restructuration des soins de santé primaires (SSP). Cet article décrit le travail accompli depuis 2003 en Colombie-Britannique afin de : (1) créer un modèle logique axé sur les résultats inspiré par la démarche du Conseil du Trésor du Canada pour la conception de cadres de travail visant la gestion ou l'obligation red- ditionnelle, ainsi que par une revue de la littérature, une analyse des politiques et une vaste consultation auprès de 650 personnes; (2) déterminer les priorités en matière d'information au sein de ce modèle logique; (3) employer le modèle et les priorités pour établir la recherche et les mesures du rendement; et (4) déterminer, dans le contexte des SSP, la structure nécessaire des systèmes d'information dans le but d'évaluer l'impact des variations ou des changements dans les intrants, les activités et les extrants touchant aux résultats pour les patients, la population et le système de santé. Le modèle logique qui en découle permet la distinction entre différents résultats pour lesquels le secteur des SSP devrait être plus ou moins responsable.



OVER THE PAST DECADE, FIRST MINISTERS HAVE MADE A NUMBER OF COMMITMENTS to renew primary healthcare (PHC) in Canada and to enhance accountability and transparency regarding those investments (Government of Canada 2000, 2003, 2004, 2006). All federal, provincial and territorial governments now support renewal initiatives designed to improve the organization, funding and delivery of these services. While it is possible to use case studies, project evaluations and anecdotal evidence to learn about the impact of renewal initiatives and highlight progress, population-based information and reporting systems are needed as healthcare policy makers and managers seek to monitor the performance of this sector, identify areas requiring attention and action, assess the relative impact of different strategies to catalyze renewal and account to citizens on progress.

If PHC information systems are to generate relevant information, then these systems must be designed to (a) monitor and report on indicators of performance important to stakeholders, (b) support identification of factors associated with improvements or declines in service quality and (c) measure whether objectives of reform are being achieved. In essence, they must be structured using robust methods of organizing and analyzing data to support performance management and research. The purposes of this paper are to describe work conducted in British Columbia since 2003 to (a) create a Results-Based Logic Model for PHC that reflects the approach of the Treasury Board of Canada in designing management and accountability frameworks, (b) identify priorities for information within that logic model, (c) use the logic model and priority within it to implement performance measurement strategies and (d) describe how information systems need to be structured to assess the impact of variation or change in PHC inputs, activities and outputs on patient, population and healthcare system outcomes.

The Treasury Board of Canada focuses on implementing performance measurement to guide quality improvement and public reporting. The first step in this approach is the creation of a results-based logic model that linearly links resource inputs to activities performed, services delivered and outcomes achieved based on the goals and objectives defined for a policy, program or initiative. In this process, a results-based logic model can be used to focus and unify evaluative efforts by enabling diverse stakeholders to work from a shared conceptual foundation and lexicon of inputs, activities, outputs and outcomes. The model establishes a common theory about the logic links among these different dimensions and a shared set of assumptions about these dependencies. It illuminates the array of activities that are potential levers for change, recognizes the unique and distinguishing features of PHC and outcomes attributable to this sector and identifies the way in which PHC and other health sectors converge to affect health system-level performance and the health of the population. As such, the model defines the areas in which information, evaluation and evidence are needed for policy, administrative and practice communities to plan,

implement and report on PHC renewal. The second step in the process is the identification of indicators of performance. Subsequent steps include monitoring, research and reporting in order to identify and communicate opportunities to improve the speed and direction of progress in strengthening primary healthcare.

## What Did We Do and What Did We Learn?

### A conceptual framework: Performance measurement and accountability in PHC

We chose the approach of the Treasury Board of Canada in designing a results-based management and accountability agenda because outcome-oriented frameworks have underpinned health system transformations that have produced rapid and impressive improvements in quality of healthcare (Asch et al. 2004; Kizer 1999). The Treasury Board's "modern management agenda" is outlined in *Results for Canadians: A Management Framework for the Government of Canada* (Treasury Board of Canada 2000). It recognizes that public services exist to serve Canadians and that a citizen focus must be built into all government-funded activities, programs and services. The objective is achievement of "results" for Canadians. This approach focuses on measuring and reporting on outcomes throughout the life cycle of a policy, program or initiative, and on integrating strategy, people, processes and measurement to improve decision-making and drive change (Treasury Board of Canada 2001).

To create the Results-Based Logic Model for PHC we conducted a policy analysis, reviewed the literature and consulted with stakeholders. To identify the goals and objectives relevant to PHC renewal in Canada, we conducted an analysis to identify prominent and recurring themes in relevant policy statements and documents such as the final reports of the Commission on the Future of Health Care in Canada (Romanow 2002) and the Standing Senate Committee on Social Affairs, Science and Technology (Kirby 2002) as well as the objectives of the Primary Health Care Transition Fund (Government of Canada 2000, 2001). The logic model aligns with First Ministers' objectives for PHC renewal as articulated in recent policy documents (Government of Canada 2003, 2004).

We also reviewed existing conceptual models of health/illness, healthcare and PHC that have been informed by (or inform) health services and policy research (Aday 2001; Andersen and Newman 1973; Donabedian 1966; Lamarche et al. 2003; Starfield 1992). This review was done to identify important dimensions of PHC relevant to access, services and outcomes. Existing performance measurement and accountability frameworks were reviewed with particular focus on PHC frameworks used in other countries (e.g., Sibthorpe and Gardner 2007; Department of Health 1999). Finally, a literature review was conducted to identify PHC inputs, activities, outputs and outcomes as well as to substantiate the relationships among them as determined through research.

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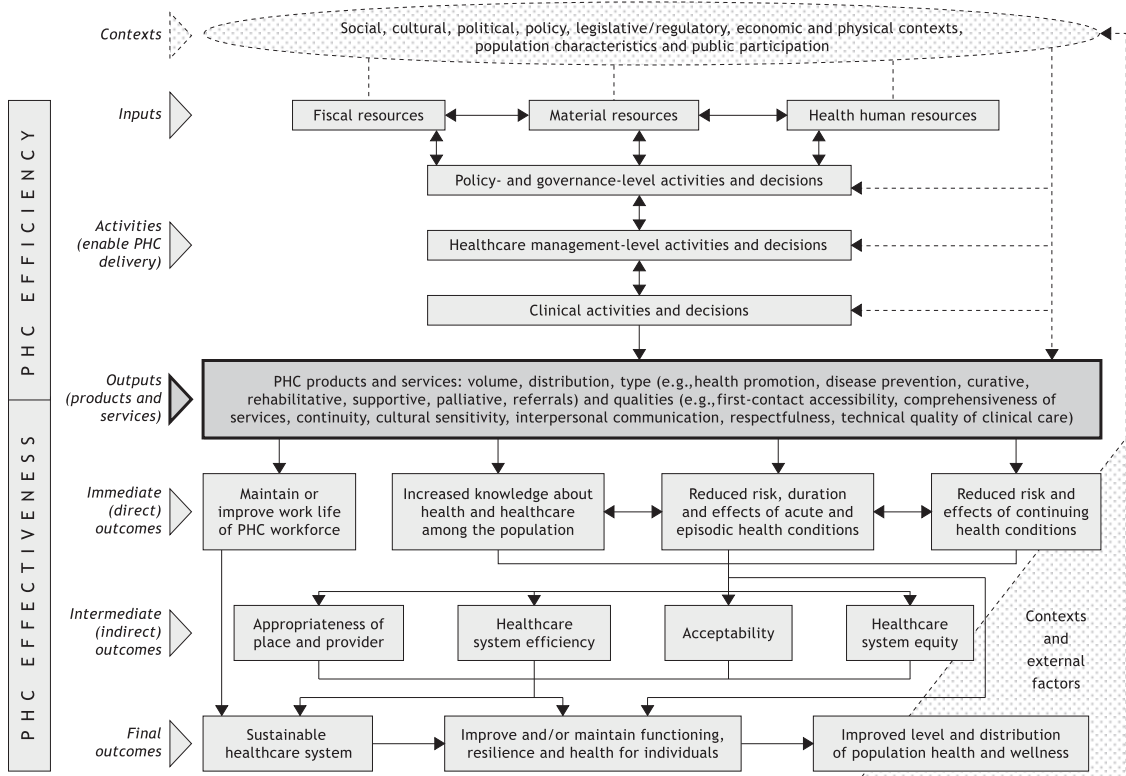
A multi-stage iterative feedback and revision process was used for stakeholder consultations. These consultations were undertaken for a period of nine months, and the model was continually revised in response to feedback. The following stakeholder groups received formal requests for comment, participated in small focus groups or attended presentations to solicit feedback on draft versions of the model: PHC practitioners from various health regions responsible for delivering PHC and implementing or evaluating renewal in British Columbia (~200 people in small focus groups); individuals from university departments or professional associations/colleges representing medicine, family medicine, nursing and pharmacy (~40 people via interviews); senior academic researchers and consultants across Canada who specialize in PHC research and evaluation (~10 people sent formal request for written feedback); PHC leaders and evaluation specialists who work for provincial and territorial ministries of health (~50 people in small focus groups); and participants who attended a session hosted at a national conference for PHC (~350 people via an open request for written feedback).

PHC was defined as products or services designed to address acute and episodic health conditions and to manage chronic health conditions. It is also where health promotion and education efforts are undertaken, where patients receive first contact care and where those in need of more specialized services are connected with other parts of the healthcare system. We focused principally on services directed towards individuals, rather than PHC services directed towards communities and contexts that influence health. The Results-Based Logic Model for PHC is summarized here (Figure 1) and described in more detail elsewhere (Watson et al. 2004).

In the Results-Based Logic Model we identify inputs as the resources used to carry out activities, produce outputs and accomplish results. *Inputs* include fiscal (e.g., amount of funding), material (e.g., information technology; office size and layout) and human resources (e.g., number and types of providers). PHC *activities* are the work processes intended to enable, support or produce specific outputs or products and services and are the primary link in the chain through which outcomes are achieved. PHC activities are differentiated from outputs in that the former are undertaken “in preparation” for delivery of PHC products and services. These activities can be categorized into three types: policy- and governance-level activities and decisions (e.g., financing and regulation), healthcare management-level activities and decisions (e.g., hours of operation; use of teams) and clinical-level activities and decisions that support outputs (e.g., training in quality improvement; the degree to which clinicians elect to specialize in specific types of clientele such as older adults). Together, these elements form the structure and foundation of a PHC system.

PHC *outputs* are direct products or services delivered as a result of PHC activities and represent the interface between this sector and individuals. PHC services and products (e.g., visits; information brochures) can be described by volume, distribution, type and qualities. PHC outputs can be further described in terms of their distribu-

FIGURE 1. Results-Based Logic Model for PHC



tion: who gets how much of what types of services and products. Types of output include health promotion and disease prevention as well as curative, rehabilitative, supportive and palliative services to targeted individuals or populations. As gatekeepers, PHC providers also offer referrals to specialty providers. Finally, PHC services and products can be described and measured in terms of distinguishing qualities, for example, first-contact accessibility, comprehensiveness of services, continuity, cultural sensitivity, interpersonal communication, respectfulness, technical quality of clinical care and so on. While terms to describe PHC outputs are abundant, the Results-Based Logic Model for PHC relies on a limited set of important attributes and operational definitions achieved through consensus among Canadian experts (Haggerty et al. 2007).

PHC *outcomes* represent “results” for Canadians. PHC outcomes can be immediate, intermediate or final, depending on the degree – as identified by stakeholders – to which the PHC sector should be held more accountable (immediate outcomes) or less accountable (intermediate and final outcomes). Immediate outcomes are those most directly attributable to outputs and for which the PHC workforce of policy makers, managers and practitioners can reasonably assume control, responsibility and account-

ability. Indeed, we opted to develop a Results-Based Logic Model to distinguish among immediate, intermediate and final outcomes because no other conceptual framework differentiates outcomes for which PHC should be held more or less accountable.

Three immediate outcomes are, for the most part, under direct control of the PHC sector: increased knowledge about health and healthcare among the population; reduced risk, duration and effects of acute and episodic conditions; and reduced risk and effects of continuing health conditions. A fourth immediate outcome is the maintenance or improvement of the work life of the PHC workforce.

Intermediate outcomes include areas in which PHC stakeholders have a lesser degree of control, but for which PHC services are still expected to have an impact. These outcomes include appropriateness of provider and place (e.g., minimize unnecessary use of emergency room services); healthcare system efficiency (e.g., avoidable hospitalizations such as admissions for asthma); acceptability or satisfaction; and healthcare system equity (e.g., individuals who receive healthcare directly from PHC or via its gatekeeper function are those most in need; individuals with similar need receive similar levels of care). Final outcomes are the long-term, ultimate objectives of PHC for individuals, the population and the healthcare system. They include a sustainable and accountable healthcare system; improvement and maintenance of function, resilience and health for individuals; and improved population-level health and wellness.

The Results-Based Logic Model for PHC (Figure 1) includes shaded boxes and arrows that represent contexts and expected linkages among inputs, activities, outputs and outcomes. Care has been taken to highlight special circumstances. For example, shaded boxes and arrows have been included to highlight that:

- external forces (social, cultural, legal/regulatory, physical and economic contexts, as well as population characteristics and participation in PHC) influence inputs, activities, outputs and outcomes;
- health human resources influence and are influenced by policy, governance and management activities and decisions as well as fiscal inputs;
- policy/governance, management and clinical activities and decisions are influenced by population characteristics, public participation and contexts;
- PHC products and services are influenced by policy/governance, management and clinical activities as well as population characteristics and contexts;
- immediate outcomes that relate to clients/patients influence one another and, collectively, influence intermediate outcomes, and also have a direct effect on one final outcome – improvement and maintenance of functioning, resilience and health for individuals who receive PHC;
- the immediate outcome that relates to maintaining or improving the work life of the PHC workforce has a direct influence on sustainability of the healthcare system.

In accordance with the Treasury Board approach, the efficiency of the PHC system is seen as a function of inputs, activities and outputs. For example, efficiency can be assessed by comparing outputs per unit of inputs. By comparison, effectiveness of the PHC system is a function of outputs and outcomes. Because external factors affect immediate, intermediate and final outcomes, statistical analytic methods are required to attribute PHC inputs, activities and outputs to relevant health and health system outcomes. This type of analysis can be used to test the association and direction of linkages among concepts reflected in the logic model. Equity or the relative distribution of resources can be measured from multiple perspectives: at the population or subgroup level and across inputs, outputs and outcomes.

### **Priorities for information: Accountability and performance improvement in PHC**

The Results-Based Logic Model for PHC describes this sector from macro-, meso- and micro-levels and, essentially, includes the universe of relevant constructs. The next challenge is to define priorities for information among healthcare policy makers, managers, providers and the public to design data systems strategically to meet these needs. The following projects represent initiatives carried out in British Columbia and elsewhere using this logic model to identify priorities for information relevant to PHC in Canada.

*Priorities for Quality Improvement.* In 2005, in order to establish priorities for quality improvement and performance measurement from the public's perspective, we conducted 11 focus groups with adults in British Columbia (n=75) to identify the dimensions of PHC that they think are important and mention in discussions regarding areas that could be improved. A content analysis was conducted using a coding scheme based on the Results-Based Logic Model for PHC. These analyses revealed six dimensions in the following rank order of priority:

1. first-contact accessibility;
2. continuity;
3. responsiveness in terms of waiting in the office and the amount of time spent with the healthcare provider;
4. interpersonal communication;
5. technical quality of clinical care; and
6. whole-person care.

The dimensions most frequently associated with acceptability and satisfaction were interpersonal communication and continuity of care (Wong et al. 2008). This infor-

mation can now be used to target initiatives to improve quality in ways that align with priorities among the public; it could also be used in priority-setting exercises regarding performance measurement to support public reporting. Recent work by others should also inform this agenda (Berta et al. 2008).

*Policy Synthesis and Evaluation.* In 2005, in order to identify a core set of evaluation questions deemed a priority among policy makers, managers, providers and academics in Canada, Haggerty and Martin (2005) synthesized national and international policy documents. Then they conducted key-informant interviews, devised a national consensus process to ensure face validity and used the Results-Based Logic Model for PHC to ensure content validity. This work was commissioned by Health Canada as part of the federal, provincial and territorial government-sponsored National Evaluation Strategy. The result was a set of 39 evaluation questions and seven policy objectives that laid the foundation for the identification of performance indicators by the Canadian Institute for Health Information (CIHI 2006a).

*Performance Indicators.* In 2005, CIHI used scientific evidence and national consultations to identify 105 performance indicators (30 of them high-priority) relevant to these evaluation questions (CIHI 2006a, 2006b). In order to assist readers who seek to categorize these indicators into contexts, inputs, activities, outputs and outcomes as highlighted in our Results-Based Logic Model for PHC, we developed a document that is available on our website ([www.chspr.ubc.ca](http://www.chspr.ubc.ca)).

Importantly, priority indicators represent dimensions relevant to performance monitoring (i.e., boxes in the logic model), but any assessment of evaluation questions requires statistical analyses to assess the association and direction of linkages between these dimensions (i.e., arrows in the logic model). For example, one of the above-mentioned seven policy objectives is “to increase the emphasis on health promotion, disease and injury prevention and chronic disease management” (CIHI 2006a). Performance indicators can be used to measure and monitor the degree to which this shift in emphasis occurs over time. One of the 39 priority evaluation questions associated with this policy objective is “Do self-management strategies for patients with chronic conditions significantly improve the quality of life, reduce the number of visits to specialists and reduce hospital admissions (number and length of stay)?” (CIHI 2006a). Analyses are required to assess the degree to which this type of chronic disease management strategy (i.e., self-management as a PHC output) improves quality of life (i.e., final outcome) and reduces use of specialists and hospitals (i.e., intermediate outcome). As such analysis involves testing the strength of association or links between outputs and outcomes, PHC information systems must be organized to support this type of evaluative work.

## Developing and using priority information for accountability and performance improvement

Since 2005, the Results-Based Logic Model for PHC has been used or customized for use, for example:

- to structure a systematic review conducted by a team in Australia to summarize expected outcomes of alternative PHC service delivery models (McDonald et al. 2006);
- to guide the development and use of a population-based information system at the Centre for Health Services and Policy Research at the University of British Columbia;
- to design a performance measurement and accountability strategy for a foundation that supports PHC services targeted to special populations (Ontario Neurotrauma Foundation 2006);
- to evaluate PHC renewal in the Yukon and community health centres in Central America, China and Ontario;
- to develop the *Canadian Survey of Experiences with Primary Health Care (CSE-PHC)* which was conducted by Statistics Canada in 2007 at a national level with sponsorship from the Health Council of Canada and in 2008 at the national and provincial levels with sponsorship from the Health Council of Canada and the Canadian Institute for Health Information; and
- to guide analyses of the CSE-PHC survey data regarding, for example, the simultaneous impact of PHC activities (interdisciplinary teams) on output type (emphasis on health promotion and disease prevention), output qualities (experiences with accessibility; comprehensiveness of services) and intermediate outcomes (acceptability; use of emergency departments and hospitalization; confidence in the health-care system) (Khan et al. 2008; Watson et al. forthcoming in *Healthcare Policy*).

Because the Results-Based Logic Model has been used extensively across jurisdictions, it is now available in English, Chinese, French and Spanish ([www.chspr.ubc.ca](http://www.chspr.ubc.ca)).

## What Are the Implications?

Now that work has been done to identify a framework, priorities for information, relevant evaluation questions and performance indicators, a PHC information system needs to be structured to measure these dimensions and support attribution analyses at provincial and national levels. Such analysis requires that data systems measure shifts over time in priority dimensions, as well as the factors that influence temporal, geographic and organizational variation in patient, population and healthcare system outcomes.

Because data relevant to measuring these dimensions often reside in different

databases, linkages between them are often required to support person-specific analyses (i.e., provider or patient) and nested data structures (e.g., providers reside or are nested within organizations, and patients reside or are nested within health regions) (see Watson 2009; page 105 of this special issue of *Healthcare Policy*).

Individual-level linkage of person-specific data offers the opportunity to aggregate anonymized information across databases about (a) the population perspective, to create a fuller understanding of peoples' use (or non-use) of health services, or (b) the provider perspective, to create a richer picture of professionals' practice patterns. Individual-level linkages between person-specific and organizational- or area-level information create nested data structures that offer the opportunity to test hypotheses regarding, for example, the impact of different organizational characteristics or community contexts on supply, distribution, delivery and use of PHC services.

Illuminating the impact of government commitments to renew PHC and assessing the impact of initiatives to catalyze changes require that information systems be designed to offer a temporal perspective on system performance. While it is also important to monitor and report on supply-side changes in the organization and delivery of healthcare from the provider perspective, it is the *results* of these renewal initiatives on temporal shifts in patients' experiences that are most important to quality improvement and to Canadians. Thus, the juxtaposition of population- and provider-based perspectives across time offers the most meaningful information to those charged with improving PHC or reporting to Canadians.

To track the effects of efforts to renew PHC, information systems must be designed to offer insights at the geographic and organizational levels. Information often needs to be aggregated, measured and reported on a regional basis, because the governance and accountability structure of healthcare in Canada – as established through legislative authority – is assigned to geographic regions. Thus, in most jurisdictions, governments, regional authorities and community health centres are responsible for community-based healthcare services delivered to all people who reside in a catchment area. In some jurisdictions, however, information needs to be aggregated, measured and reported at the level of an organization or network of organizations, because these entities are responsible, through contractual relationships, for services delivered to defined patient populations. In these instances (e.g., Primary Health Care Organizations or Integrated Health Networks in British Columbia, Primary Care Networks in Alberta, Family Health Teams in Ontario) there will be a greater need to measure and report on PHC inputs, activities, outputs and outcomes at the organizational level. But support for geographic-based analyses will continue to be important to governments and Canadians, because emerging evidence suggests that the strength of the PHC sector relates to the composition of primary, secondary and tertiary provider organizations in a region. Thus, initiatives to strengthen the PHC system in a region will always require geographic-based analyses.

## Conclusion

In order to understand and account for the impact of targeted investments in PHC renewal and identify areas requiring improvement, many individuals and groups have invested energy in establishing indicators of PHC system performance. These efforts represent important contributions to the development of new standards of accountability. However, the lack of connections and conceptual links among disparate performance measures has created an administrative burden for providers, and is a significant barrier to moving the quality agenda forward (Institute of Medicine 2006). This lack of explicit connections and conceptual links among indicators is evident across Canada and internationally. It is compounded by the dearth of PHC information systems to support performance measurement. This situation has a high potential for burdening administrators and providers, who may then simply not follow through with the necessary work. As a result, the collective good efforts of many will fail to be translated into a cohesive and feasible strategy to support performance measurement, quality improvement and accountability.

Although a number of conceptual frameworks are used to profile healthcare systems and guide the design of information systems, none differentiates the unique features of the PHC sector or the outcomes attributable to it. The Results-Based Logic Model for PHC identifies health and healthcare outcomes for which the PHC sector should be held more or less accountable. The work outlined in this paper to create a cohesive, outcome-oriented framework, and to identify work completed to identify priorities for information, is intended to streamline efforts to support performance measurement and accountability.

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# Measuring the Performance of Primary Healthcare: Existing Capacity and Potential Information to Support Population-Based Analyses

Mesure du rendement en matière de soins  
de santé primaires : capacité actuelle et  
information potentielle pour les analyses  
fondées sur la population



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## **Abstract**

*What did we do?* We reviewed the degree to which existing population-based data in Canada can be used to describe and report on primary healthcare (PHC) performance. We identified gaps in current data sources and made recommendations on how these gaps might be addressed to support quality improvement and public reporting for PHC.

*What did we learn?* Population-based survey and administrative data are available to describe population characteristics and other contextual factors for PHC, as well as some aspects of the material, financial and human resources inputs, and selected activities and decisions at the policy, management and clinical levels. Existing data can also be used to describe some volumes and types of PHC outputs. However, we currently have limited population-based data to assess selected qualities of PHC services (e.g., coordination and interpersonal effectiveness) and most immediate outcomes of PHC. The ability to link data to assess outcomes and attribute changes in outcomes to PHC is limited. A full report describing more than 130 indicators from existing data sources and gaps in current data is available at [www.chspr.ubc.ca](http://www.chspr.ubc.ca).

*What are the implications?* As we look to the future, there is a clear need to build on existing data sources to expand PHC data capacity in Canada. Data are needed to inform an understanding of PHC outputs, outcomes and the linkages among PHC dimensions. Commitment to a comprehensive PHC data collection strategy and information system is needed across Canadian provinces and territories to inform policy development and planning, to evaluate PHC redesign initiatives and to meet the accountability expectations of Canadians.

## Résumé

*Ce que nous avons fait* : Nous avons examiné à quel point les données démographiques actuelles peuvent être employées pour faire un compte rendu du rendement des soins de santé primaires (SSP). Nous avons décelé des lacunes dans les sources actuelles de données et nous avons fait des recommandations afin de traiter ces lacunes, dans le but de favoriser une amélioration de la qualité et de la diffusion publique d'information en matière de SSP.

*Ce que nous avons appris* : Il existe des données administratives ou issues de sondages auprès de la population qui peuvent servir à décrire les caractéristiques de la population ou d'autres facteurs contextuels pertinents aux SSP, de même que certains aspects touchant aux intrants en matière de ressources matérielles, financières et humaines, et certaines activités ou décisions aux niveaux politique, clinique ou de gestion. Les données disponibles peuvent également servir à décrire certains types et volumes d'extrants dans les SSP. Toutefois, il existe actuellement peu de données de nature démographique qui permettent d'évaluer les critères de qualité en matière de services de SSP (par exemple, la coordination et l'efficacité interpersonnelle) ou encore les résultats immédiats pour les SSP. La possibilité d'associer les données pour évaluer les résultats et les changements connexes est également limitée. Un rapport détaillé décrivant plus de 130 indicateurs à partir des sources de données actuelles, et présentant les lacunes dans les données, est disponible sur le site [www.chspr.ubc.ca](http://www.chspr.ubc.ca).

*Répercussions* : Dans une perspective d'avenir, il faut clairement enrichir les bases de données actuelles afin d'accroître le potentiel des données sur les SSP au Canada. Les données sont nécessaires pour faciliter la compréhension des extrants et des résultats des SSP et pour faire des associations entre les divers aspects des SSP. Un engagement envers une stratégie pour la collecte de données détaillées et envers un système d'information est indispensable dans toutes les provinces et tous les territoires canadiens afin de renseigner l'élaboration et la planification des politiques, d'évaluer les initiatives de restructuration des SSP et de satisfaire aux attentes des Canadiens en matière d'obligation redditionnelle.

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CANADIANS HAVE EXPRESSED CONCERN ABOUT ACCESS TO AND QUALITY OF primary healthcare (PHC), as well as support for changes to PHC including collaborative team-based care (Pollara 2005; Watson and Krueger 2005). They have also indicated concern for accountability and a desire for increased transparency and reporting on the results of healthcare expenditures and renewal initiatives (Pollara 2003). In response, federal, provincial and territorial governments have made

substantive, multi-year investments in healthcare reform and have committed to regular reporting on health system performance and progress towards system renewal in the First Ministers' communiqué on health (Canadian Intergovernmental Conference Secretariat 2000), the Primary Health Care Transition Fund (Health Canada 2000), the First Ministers' Health Accord (Health Canada 2003) and the First Ministers' 10-Year Plan to Strengthen Health Care (Health Canada 2004).

Despite investments in PHC renewal and a commitment to increased public reporting, a performance measurement and accountability framework for this sector has not been established in Canada. Such a framework is needed, along with population-based data, to support policy and management initiatives to improve quality and report on progress resulting from renewal initiatives. The creation of information systems to support this agenda should leverage existing data collection, monitoring and reporting and be supplemented with new data sources and systems that fill information gaps in priority areas.

In response to this challenge, researchers at the Centre for Health Services and Policy Research developed the Results-Based Logic Model as a guide for developing a population-based PHC information system and evaluating PHC (Watson et al. 2004). Concurrently, we undertook a review of PHC performance measurement in Canada to identify existing data sources for PHC reporting. The purpose of this paper is to illustrate how existing population-based administrative and survey data can be used to describe dimensions of PHC. We identify gaps in existing data and priorities that should be addressed for PHC reporting, and offer suggestions to address these gaps. This report will be of interest to those responsible for planning future data requirements and information systems for PHC, along with those undertaking PHC evaluation and research across Canada.

## What Did We Do?

Our work was guided by the Results-Based Logic Model for PHC described earlier in this special issue of *Healthcare Policy* (Watson et al. 2009a; see page 33). The Results-Based Logic Model was developed using the approach of the Treasury Board of Canada to performance management and accountability reporting. This approach focuses on measuring and reporting outcomes throughout the life cycle of a policy, program or initiative and integrating strategy, people, processes and measurement to improve decision-making and drive change. Beginning with the creation of a results-based logic model, this approach uses indicators to assess performance along with analyses to link variation in resource inputs and activities performed to changes in outputs and outcomes achieved (Treasury Board of Canada 2001).

We used the Results-Based Logic Model to guide our review of population-based data sources and performance measures in Canada. To identify performance indicators

that are currently available for dimensions of the Results-Based Logic Model, we examined existing population-based data sources, including surveys of citizens, surveys of providers and reports describing the use of administrative data. This information illustrates the potential to use existing data sources to measure PHC inputs, activities, outputs and outcomes. The data sources and performance measures identified in this paper are not exhaustive; rather, the information is intended to illustrate availability from existing robust and accepted data sources. Similarly, this information is not intended to describe the “best” or preferred performance measures. Our full report, including more than 130 performance indicators, is available on the website of the Centre for Health Services and Policy Research (Broemeling et al. 2006).

This information was then used to identify gaps in current data available to report on PHC dimensions and renewal initiatives. We also used results from work, as well as consultations with citizens, to identify priorities for information and make recommendations to guide planning for future data collection and PHC information systems (see Watson et al. 2009a; page 35 in this special issue).

## What Did We Learn?

Table 1 provides examples of measures that are available or can be derived from existing survey and administrative data sources. Measures of intermediate and final outcomes are not described in Table 1 because the attribution of these outcomes to PHC is limited by the impact of external factors.

**TABLE 1.** PHC performance measures using existing population-based data sources

Dimension	Survey Data	Administrative Data
Population characteristics & contexts		
Demographics	Population estimates, distribution by age, gender, geography: 2001 Census of Canada (Statistics Canada 2006a)	Vital statistics: births, deaths (British Columbia Ministry of Health Vital Statistics Agency 2006)
Health Status	Chronic condition prevalence rates: self-reported chronic conditions – Canadian Community Health (CCHS) Survey, Cycle 3.1 (Statistics Canada 2006b), Q011–Q221	Chronic condition treatment prevalence rates: diagnoses from medical, hospital and other administrative sources (Broemeling et al. 2005)
Health Behaviours	Health behaviours, changes to improve health: CCHS Cycle 3.1, CIH_Q1 to CIH_Q8	
Social, Economic, Cultural, Physical, Policy/Legislative Contexts	Income, labour force participation, education, ethnicity: 2001 Census of Canada	Risk indices: children at risk (BC STATS 2009)

TABLE 1. Continued

Inputs		
Health Human Resources	GP/FP age, sex distribution: National Physician Survey (NPS) (College of Family Physicians of Canada 2004), Q31, Q32	GP/FP-to-specialist ratio (College registration data) PHC nurse-to-PHC physician ratio (Wong et al. 2006)
Material Resources	Internet access in main patient care area: NPS 2004, Q22	Hospital beds (Annual Return of Healthcare Facilities)
Fiscal Resources		Public sector expenditures (CIHI 2005a)
Activities		
Policy/Governance Level	Remuneration method: FFS, capitation, salary, blended, others – NPS 2004, Q14	Distribution of physician expenditures by physician payment category: FFS, salary, sessional, capitation, others (CIHI 2006)
Management Level	GP/FP patient care setting: solo, group, practice network, other: NPS 2004, Q3a Nurse or other healthcare professional that is regularly involved in your care: 2008 CSE-PHC, Question HU_Q01, Q02	Primary care physicians in group practice (Reid et al. 2003)
Clinical Level	GP/FP participation in maternity, newborn care: NPS 2004, Q9	GP/FP provision of non-office care: emergency, intrapartum, nursing home, house call, others (Chan and Ovens 2002)
Outputs		
Volume and Type	Contacts with health providers: CCHS Cycle 3.1, HC_Q02, Q03 Patient visits/week, exc. call: NPS 2004, Q_C6	GP/FP or PHC visits and visit rates/ population (Watson et al. 2005)
Accessibility	Difficulty obtaining routine or ongoing health services: derived from CCHS (see Sanmartin et al. 2004) Length and acceptability of wait for routine or ongoing care, as well as immediate care for a minor health problem: 2008 CSE-PHC Question AC_Q10, Q11, Q16, Q17	Utilization rates (i.e., realized access) (Menec et al. 2002)
Continuity	Proportion of population who report having a regular family doctor: derived from CCHS (see Sanmartin et al. 2004) How long have you been seeing or going to this primary care provider: 2008 CSE-PHC Question HU_Q03	Relational continuity: usual care provider, preponderance of care (Reid et al. 2003)

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TABLE 1. Continued

Comprehensiveness	Use of preventive measures, e.g., blood pressure check, Pap test, mammography: CCHS Cycle 3.1, BPQ010-016, PL_Q020-026, MA_Q030-036; BX_Q110-BS_Q122; EX_Q140-Ex_Q146; PC-Q150-PC_Q156, FS_Q160-FS_Q166	Use of primary prevention (e.g., immunization) and secondary prevention (screening) services (Lix et al. 2005)
Coordination of Care	How often does your primary care provider help you coordinate the services you receive from other doctors and places when you need it: 2008 CSE-PHC Question HU_Q05	
Interpersonal Communication	In the past 12 months, how often did your family physician (or general practitioner) explain your test results in a way that you could understand: 2008 CSE-PHC Question EP_Q01	
Technical Effectiveness	In the past 12 months, did you get the following tests or measures to monitor your condition: 2008 CSE-PHC Question CC_Q02	Chronic disease patients: receipt of recommended care (Katz et al. 2004)
Immediate outcomes		
Maintain or Improve Work Life of PHC Workforce	GP/FP satisfaction with professional life: NPS 2004, Q20	
Increased Knowledge about Health and Healthcare among Population	Changes in risk behaviours: CCHS Cycle 3.1, CIH_Q1 to CIH_Q8 Knowledge about each prescribed medication: 2007 CSE-PHC Question J2	
Reduced Risk, Duration and Effects of Acute/Episodic Health Conditions		
Reduced Risk and Effects of Continuing Health Conditions		Hospitalization rates/readmissions to hospital for specific chronic conditions (CIHI 2005b)

### Population characteristics and contexts

Population characteristics include health status, behavioural, psycho-social and social support measures and health-related attitudes and preferences. Contextual factors such as social cohesion, social capital and income disparity, and policy and legislative contexts also influence health, patterns of use and delivery of PHC services. A number of population and contextual measures are available or can be derived from existing data sources. Administrative data from provincial medical services plans, vital statistics and program utilization files can be used to describe populations, morbidity, treatment

prevalence rates for chronic health conditions and mortality. Survey data, including the Canadian Community Health Survey (CCHS) (Statistics Canada 2006b), also provide such important information on population characteristics as self-rated health, disability, activity restrictions, self-reported chronic health conditions, behavioural risks and medical interventions.

## PHC inputs

Human, material and fiscal resources are the inputs that PHC systems rely on to carry out activities, deliver care and achieve results. Health human resources input measures are available both from provincial administrative data sources (provincial colleges of physicians and surgeons registrations and colleges of registered nurses, provincial medical services plans) and from national databases such as the National Physician Database. Survey data sources include such measures as intention to retire and plans to move during the coming year from the National Physician Survey (NPS). Material inputs (e.g., information systems, electronic health records) and financial inputs are also available from administrative and survey data sources.

## PHC activities

PHC activities describe the work processes undertaken in preparation for delivery of PHC products and services. Activities support the production of outputs and the achievement of outcomes. Three levels of activities are identified: policy and governance, healthcare management and clinical. Policy and governance measures include financing and funding of services. Funding information is currently collected from provincial medical payment administrative data; financing information could be, but is not currently, collected from patient surveys.

Healthcare management activities include decisions about the degree to which practices include interdisciplinary teams or offer services 24 hours a day, seven days a week. Data relating to practice settings and organization are available from the NPS (CFPC 2008). Information about the degree to which patients receive PHC from multidisciplinary teams could be obtained from population surveys, such as the *Canadian Survey of Experiences with Primary Health Care* (CSE-PHC) which was conducted in 2007 and 2008 (Statistics Canada 2009). Clinical-level activities and decisions can also be measured using existing data sources. For example, physician participation in delivery of maternity care is available from NPS data. Many healthcare management and clinical activity measures focus on physician data sources; less information is available for other providers.

## PHC outputs

Outputs are the services and products that result from PHC activities: that is, the services delivered by PHC providers and received by patients. The volume and type of PHC services used by the population overall and by population subgroups can be described using such measures as annual check-ups, screening tests and physician visits for mental health conditions with information from both administrative and survey data. Administrative data sources quantify the number and type of visits covered by publicly funded services, while survey data describe service use from patient and provider perspectives. The 2008 CSE-PHC was conducted by Statistics Canada and designed to offer national and provincial-level estimates regarding the types of services that adults receive (e.g., health promotion, disease prevention) as well as the places they visit for that care (e.g., walk-in clinics).

Qualities of PHC outputs describe the distinctive features of PHC – first-contact accessibility, comprehensiveness of services, continuity, cultural sensitivity, interpersonal communication, respectfulness, technical quality of clinical care and so on. Selected qualities of PHC outputs can be described using existing data sources. Accessibility can be reported using both survey and administrative data. Surveys such as the CCHS (Statistics Canada 2006b) include perceptions of accessibility and barriers to care, availability of services when needed, convenience of PHC services and degree to which there is unmet need. The 2008 CSE-PHC (Statistics Canada 2009) includes information on wait times and acceptability of those wait times for routine and ongoing care as well as immediate care for minor health problems. Administrative data provide measures of realized access such as use of services.

Relational continuity of care can be assessed using existing CCHS data from patients (e.g., respondents report having a regular medical doctor) and CSE-PHC data (e.g., how long have you been receiving care from your regular primary care provider), while administrative data have been used to derive continuity of care indices such as usual care provider or sequential continuity of care. Measures of informational and management continuity are generally not available from administrative data sources and require either survey or clinical information to assess (Reid et al. 2003). The CCHS does not currently include questions to assess patient experiences of PHC continuity of care.

Comprehensiveness measures describe the span of services provided in PHC, from health promotion and disease prevention through acute episodic care, ongoing chronic care and end-of-life care. Measures of comprehensiveness, such as the provision of primary or secondary preventive services, provider activity and referrals to specialist and other providers, are available using NPS survey data, as well as administrative data from provincial medical services plans. The CSE-PHC does not include questions to assess receipt of a comprehensive array of health promotion, disease

prevention and curative healthcare services from a patient perspective but it does ask respondents if they receive the full range of services they need.

Coordination, another key attribute of PHC, cannot be assessed using administrative data and must rely on survey data. While co-occurrence of services can be identified using linked administrative data (e.g., post-acute use of home care services), it is not clear whether services were actually coordinated with shared provider information and shared care management. Interpersonal communication describes provider-patient communication, shared decision-making and interpersonal style of care, and reflects the degree to which providers offer patient-centred care (Watson et al. 2004). Measures of interpersonal communication cannot be assessed using administrative data, but the CSE-PHC includes a number of items intended to measure coordination and interpersonal communication.

Finally, effectiveness of care or technical effectiveness reflects the degree to which care is consistent with evidence and knowledge and there is high consensus on the importance of this type of information to drive quality improvement (Barnsley et al. 2005). To a limited extent, administrative data can be used to assess technical effectiveness by comparing actual care provided to patients to that recommended; that is, comparing the reported use and frequency of tests, procedures and medications compared with evidence-based guidelines. Measures of technical effectiveness are not currently part of the CCHS, but a module to assess the degree to which people with diabetes reported receiving recommended laboratory tests and procedures was included in the CCHS in 2005. This module was optional, and only six jurisdictions funded data collection in their regions. More recent modules of the CCHS are being designed to measure technical quality for other chronic conditions and the CSE-PHC includes a number of items intended to measure this quality of PHC services.

## Primary healthcare outcomes

PHC outcomes are the result of inputs, activities and outputs, with immediate outcomes being most attributable to PHC.

### IMMEDIATE OUTCOMES

Immediate outcomes describe increased knowledge about health and healthcare among the population, reduced risk, duration and effects of acute and episodic conditions, reduced risk and effects of continuing health conditions, and maintenance or improvement of the work life of the PHC workforce (Watson et al. 2004). Perhaps the best information to assess PHC immediate outcomes from the provider perspective is to assess job satisfaction and work life measures which are available from existing survey data such as the NPS (for physicians). The other PHC immediate out-

comes are best measured from the perspective of patients and using longitudinal data. The CSE-PHC does offer some cross sectional data regarding Canadians' knowledge about their health and care management which can be used as a basis for performance indicators and that survey offers data on PHC activities and outputs to support attribution (causal) analyses.

Performance measures for reduced risk and effects of chronic health conditions are best measured from the perspective of patients and using longitudinal data. The CSE-PHC does offer some cross sectional data in this regard, but population-based administrative data are not readily available. While administrative data have been used to measure receipt of recommended care for patients with diabetes (technical effectiveness: PHC output), there are few jurisdictions that have administrative data which include the results of laboratory work (e.g., cholesterol or hemoglobin A1c levels) or diagnostic procedures (e.g., blood pressure) that can be used to measure the effects of care for chronic health conditions such as diabetes. Where such administrative data capacity exists, there is little capacity to link these data to information about PHC inputs, activities and outputs.

### INTERMEDIATE OUTCOMES

Intermediate outcomes include outcomes on which PHC is expected to have an impact, albeit with less control: appropriateness of provider and place, healthcare system efficiency, acceptability and equity (Watson et al. 2004). Measures for acceptability and appropriateness of place are available from survey data, including patient perspectives (CCHS and CSE-PHC) and physician perspectives (NPS). On the other hand, existing administrative data have been used to measure emergency department and hospital use (Cree et al. 2006) and ambulatory care sensitive (ACS) admissions to hospital (CIHI 2005b).

Canadian researchers have had to be creative in measuring PHC efficiency related to differences in technical effectiveness of specialists and general/family practitioners in the delivery of chronic disease management, because there are cost differences associated with variations in physician mix (Shah et al. 2003) or work to assess equity and efficiency in general/family practitioner, nursing, emergency department and home care services relative to the health status of populations (Watson et al. 2005).

### FINAL OUTCOMES

Final outcomes include a sustainable healthcare system, improved/maintained individual health and functioning, and improved level and distribution of population health and wellness (Watson et al. 2004). The complex interplay of PHC, other system factors and variations in population contexts limit the extent to which final outcomes can be attributed to PHC. The outcome of a sustainable healthcare system reflects

expectations that PHC is a key lever to manage inputs, costs and efficiency of the healthcare system. Evidence from other jurisdictions suggests that healthcare systems with strong PHC have lower overall costs than those that do not (Starfield and Shi 2002). However, there are few assessments of sustainability of the PHC sector; some explore the impact of temporal trends at the population level on future sustainability (Watson et al. 2007). In Canada and elsewhere, researchers have used area-level measures of PHC to study the influence of the PHC sector on the health of populations, healthcare and health status (Pierard 2009; Shi et al. 2003). For all intermediate outcomes and final outcomes, the challenge is to attribute changes in outcomes to PHC as opposed to other system factors.

## What Are the Implications?

Population-based data are available to describe some dimensions of the Results-Based Logic Model (Watson, Broemeling et al. 2009) and to evaluate selected aspects of PHC renewal. However, despite availability of these data and the importance of accountability and performance reporting to Canadians, there is little routine monitoring and public reporting for this sector. Such reporting would provide important information for delivering PHC services, planning PHC renewal, monitoring changes in PHC performance and assessing the impact of renewal initiatives. It would also inform the 93% of Canadians who reported that PHC is of high importance (79%) or medium importance (14%) to their future health (Health Canada 2006).

Although data are available to measure some aspects of PHC performance, many input and activity measures focus on physician data and there is less information available for other PHC providers or interdisciplinary teams. Recent studies by our team using administrative data to identify PHC nurses (Wong et al. 2006, 2009; see page 91 in this special issue of *Healthcare Policy*), and by CIHI and Statistics Canada to survey nurses (Shields et al. 2006), are useful additions to describe nursing's contribution to PHC service delivery.

Moreover, because an increasing proportion of physician services are financed through alternative funding arrangements (CIHI 2006), the availability of administrative data for performance measurement is declining. Two papers in this special issue (Broemeling, Kerluke et al. 2009 and Watson, Peterson et al. 2009) assess the degree to which completeness and accuracy of administrative data are eroding for measurement of provider and population perspectives of PHC and what can be done so that administrative data can still be used for performance measurement in Canada.

As well, our current ability to assess some qualities of PHC outputs – interpersonal communication, continuity and coordination of care – has been limited; the new CSE-PHC will enhance capacity to measure these dimensions based on individuals' experiences and linkage of that survey to administrative data will enhance capacity to

measure the impact of variation in these qualities on longer term outcomes such as use of hospitals.

There are notable gaps in existing data to assess the immediate outcomes of PHC, particularly those outcomes that require longitudinal data. Little information is currently available to assess the impact of PHC on the risks, duration and effects of acute and episodic health conditions, or the risks and effects of chronic health conditions. Data are also not readily available to measure the impact of PHC on the immediate outcome of increased knowledge about health and healthcare among the population. It is possible to incorporate this information into surveys or to extract it from electronic data; however, if the information is to be used to improve the quality of PHC, it must be linkable to information on outputs (at a minimum) or, more ideally, to inputs, activities and outputs to support evaluative research and analyses.

Selected intermediate and final outcomes can be assessed with existing data sources, but these measures are neither comprehensive nor easily linked to support the attribution of PHC inputs, activities and outputs to PHC outcomes. Many external factors, in addition to PHC, contribute to these intermediate and final health outcomes, limiting our ability to assess PHC's contribution. Longitudinal data sources linking patients and providers are needed if we are to assess the impact of PHC on individual and population outcomes and health improvements over time, as well as threats to, and opportunities to support, healthcare system sustainability.

A full evaluation of PHC renewal will require a comprehensive data collection strategy that accounts for the dimensions of PHC and the links among PHC dimensions. For example, do interdisciplinary teams improve access to recommended care for those with chronic health conditions? And how do interdisciplinary teams working to improve access to care influence the relational continuity of care between patients and providers?

A comprehensive data collection strategy would have to provide population-based, multi-level data for individual residents, patients, providers, clinics and organizations. Such an information system must support linkage of individual patients to providers, clinics and other healthcare organizations in order to attribute changes over time to PHC services and renewal initiatives. Longitudinal data are required to support temporal analyses of factors contributing to the health of Canadians. Finally, comprehensive data are needed across the PHC dimensions, from contexts to inputs, activities and outputs to outcomes, as well as the linkages among each of these dimensions.

## Recommendations

We conclude that there is population-based data capacity to begin to describe the population characteristics, contexts, inputs and activities of PHC, but insufficient data to describe outputs and outcomes and to attribute outcomes to this sector. Focusing on data sources to measure immediate outcomes for PHC, along with the linkages

among contexts, inputs, activities, outputs and outcomes, will be an important priority in supporting local, provincial and national evaluation of PHC renewal.

We recommend commitment to a comprehensive PHC data collection strategy and information system. In the short term, priorities should be established as follows:

1. Establish standardized data collection strategies across jurisdictions to address the completeness and accuracy of traditional administrative data holdings for general and family practitioners. This action is required to address the erosion in administrative data resulting from the increase in alternative payments and PHC services delivered via such arrangements.
2. Implement a regular survey of Canadians to track the unique and distinguishing features of PHC, such as type and volume of health promotion, disease prevention and curative services received, as well as patient experiences with continuity, coordination of care and interpersonal communication. Such data could be used to assess the degree of variation in volume, type and qualities of outputs with self-reported outcomes such as use of other healthcare services. While the CSE-PHC was conducted in 2007 and 2008, there are no plans dedicated towards ensuring that it be conducted on an annual or biannual routine basis.
3. Implement studies to assess policy-relevant activities such as impact of the introduction of multidisciplinary teams on PHC outputs and outcomes. Ad hoc studies are required because administrative and survey data cannot be linked to information about PHC organizational design.

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**There is remarkable potential to develop comprehensive, longitudinal and multi-layered data for primary healthcare that supports performance measurement and research at the population or system level**

In the medium to longer term:

4. Ensure that electronic health records are designed and implemented so that data for PHC outputs and outcomes are complete and reliable, and can be routinely linked to information about PHC inputs, management and clinical-level activities, population contextual factors and use of other healthcare services. A comprehensive information system would support analyses to inform quality improvement efforts and enable public reporting.

There is remarkable potential to develop comprehensive, longitudinal and multi-layered data for PHC that supports performance measurement and research at the population or system level and, at the same time, supports providers with information on care delivery to inform quality improvement efforts and planning for future needs.

We recommend the development of a Canadian PHC data collection strategy that builds on the unique qualities and strengths of population-based data. A comprehensive, collaborative PHC data collection strategy, combined with a common evaluation framework, would provide the necessary building blocks for PHC evaluation and performance measurement. The final paper in this issue (Watson 2009) offers a roadmap of options for new information systems so as to address existing gaps in high priority information about PHC in Canada. Commitment to this work is necessary if we are to meet the expectations of Canadians.

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# Developing and Maintaining a Population Research Registry to Support Primary Healthcare Research

Création et maintien d'un registre démographique  
pour la recherche sur les soins de santé primaires



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## Abstract

*What did we do?* This paper describes the creation of a population research registry as part of an information system to support primary healthcare (PHC) research in British Columbia. The population registry includes all residents of the province who were either eligible to use or actually used healthcare services, together with demographic, geographic, health status, registration and service use data. The PHC population research registry is built using administrative data inputs, and data are anonymized to comply with privacy and confidentiality standards.

*What did we learn?* The registry provides data to undertake research into PHC needs and service utilization. It facilitates both population-based research as well as research on population subgroups. Combined with anonymous physician and utilization data, the information system can be used to study service utilization rates for population-based analyses. Over the longer term, the information will contribute to our understanding of PHC qualities and outcomes.

*What are the implications?* Continued completeness of the population research registry depends upon full administrative source data. Planning to ensure complete data capture is critical both for the research registry and our ability to undertake population-based PHC research.

## Résumé

*Ce que nous avons fait :* Cet article décrit la création d'un registre de recherche démo-

graphique qui fait partie d'un système d'information pour la recherche sur les soins de santé primaires (SSP) en Colombie-Britannique. Le registre démographique recense tous les résidents de la province qui ont utilisé les services de santé ou qui y sont admissibles et comprend des données démographiques, géographiques, de même que des données sur l'état de santé, l'immatriculation et l'utilisation des services de santé. Le registre de recherche démographique pour les SSP est constitué à partir de données administratives, lesquelles conservent l'anonymat afin de respecter les normes de confidentialité.

*Ce que nous avons appris* : Le registre présente des données qui permettent de faire de la recherche sur l'utilisation et les besoins en matière de SSP. Il permet de faire à la fois des recherches démographiques et des recherches sur des sous-groupes de la population. Combiné aux données anonymes sur les médecins et sur l'utilisation, le système d'information peut être employé pour étudier les taux d'utilisation afin d'effectuer des analyses de nature démographique. À long terme, cette information aidera à mieux connaître la qualité et les résultats liés aux SSP.

*Répercussions* : Le caractère exhaustif du registre dépend d'un accès complet aux sources de données administratives. Il est essentiel de planifier une saisie complète des données tant pour le registre que pour la capacité d'entreprendre des recherches démographiques sur les SSP.

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POPULATION RESEARCH REGISTRIES PROVIDE NECESSARY FOUNDATIONAL information for primary healthcare (PHC) research and, more generally, for health services research. Data on population socio-demographic, morbidity, mortality, geographic, service registration and other characteristics provide critical information to describe and study need, demand for and use of services by the population overall and by population subgroups. Research registries using linked health data have been established in a number of jurisdictions to support population-based research initiatives (Roos and Nicol 1999; Roos et al. 2003). Data from these registries enable policy analyses, planning and management of healthcare resources (Roos et al. 2004) and information to support system-level performance measurement and evaluation of services.

This special issue of *Healthcare Policy* documents the development of an information system for PHC research in British Columbia. In this paper, we describe the development of a population research registry as part of this PHC information system. The population research registry includes almost all individuals living in British Columbia, together with anonymized core data for each individual. Strict protocols have been established to ensure security and to protect privacy and confidentiality of personal health information.

The BC population research registry can be used to identify and study groups in the province and to support analysis of treatment prevalence and other population-based rates. Not only does the registry provide data on the population, but these can be combined with data from other sources to analyze service utilization, some qualities of PHC and selected outcomes for the population. The population research registry, along with a physician information system (see Watson et al. 2009, page 77 of this special issue of *Healthcare Policy*), forms the foundation for a PHC information system to support research on population, providers and utilization of healthcare services.

## What Did We Do?

As a foundation for PHC research, we created a population research registry containing anonymized data for individual residents of British Columbia. The registry includes individuals who were eligible to receive medical services as well as residents who were not registered but who used healthcare services during the year. The population research registry provides a near-complete file of all individuals living in the province each year, together with key data for each person. It was created to provide core, population-based data while ensuring anonymity of information and complying with privacy and confidentiality requirements.

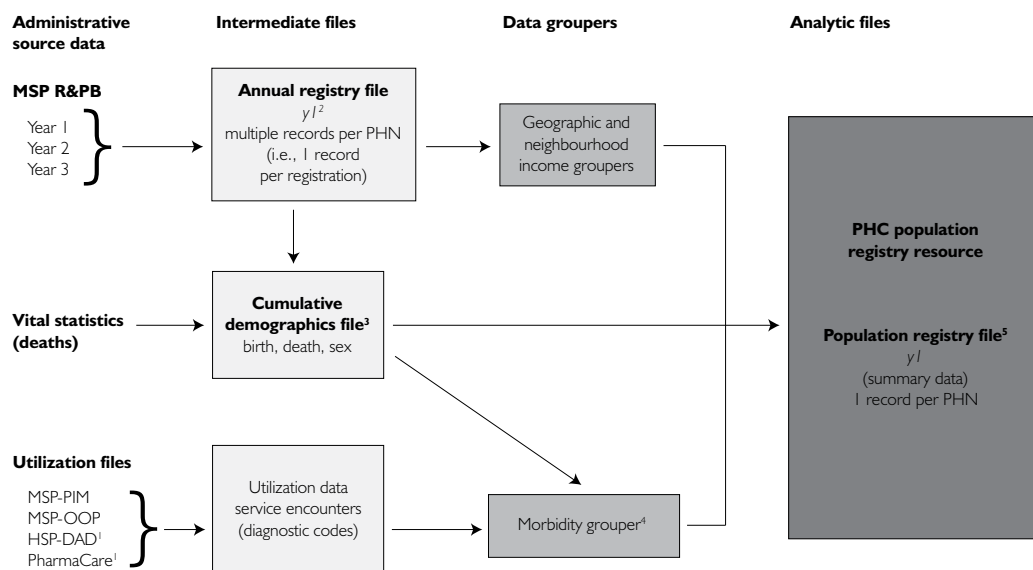
The project builds on previous work at the Centre for Health Services and Policy Research (CHSPR) to establish a population-based linked health database: the British Columbia Linked Health Database (BCLHD) (Chamberlayne et al. 1998). Using the BCLHD, our work incorporates additional information for PHC research, including derived morbidity data for individuals in the registry. While our work focuses on PHC as part of a comprehensive information system to support PHC research, it is also applicable to other health services research.

We used a three-stage process to create the anonymized population research registry, starting with (a) individual-level data from a number of existing administrative sources, (b) the creation of intermediate data files to link administrative source data and (c) the addition of derived geographic, income and morbidity data using data groupers to create summary annual population registry files for analysis. Figure 1 describes the process used to develop the registry.

Individual residents registered to receive provincial medical services were identified using Medical Services Plan Registration and Premium Billing (MSP R&PB) data. This annual registry file identifies all residents eligible to receive services and summarizes three years of medical plan data. Since the MSP R&PB files are compiled at a specific time (e.g., July 1), multiple files were required to ensure data completeness and to incorporate all registration changes. For example, the annual registry file for 2002/03 was derived from MSP R&PB files for 2002/03, 2003/04 and 2004/05 in order to ensure complete identification of registered residents (see Figure 1).

## Developing and Maintaining a Population Research Registry to Support Primary Healthcare Research

**FIGURE 1.** Developing the PHC population research registry



### Notes

<sup>1</sup> The HSP-DAD and the PharmaCare data include some out-of-province (OOP) data.

<sup>2</sup> Snapshots of years 1, 2 and 3 from MSP R&PB are combined to develop a cumulative annual registry file that represents year 1.

<sup>3</sup> The cumulative demographics file includes one record for each person ever registered with MSP in BC from 1986 forward.

<sup>4</sup> We used The Johns Hopkins ACG® Case-Mix System PC-Unix Version 5.01 licensed software, adapted for BC coding, to create the morbidity measures. Each person is assigned only one ACG but multiple ADGs and EDCs.

<sup>5</sup> The population registry file includes one record for each person either registered or a service user in that year, i.e., year y/1. It includes morbidity measures for each person.

### Abbreviations

MSP	Medical Services Plan
R&PB	Medical Services Plan Registration and Premium Billing File
PHN	Personal Health Number
MSP-PIM	Medical Services Plan Payment Information Masterfile
MSP-OOP	Medical Services Plan Out-of-Province Billing File
HSP-DAD	Hospital Separations File (Discharge Abstract Database)
ACG	Adjusted Clinical Groups
ADG	Aggregated Diagnosis Groups
EDC	Expanded Diagnosis Clusters

In addition to individual residents registered with the Medical Services Plan (MSP), the population research registry identifies individuals who were not registered but who used services. To identify non-registered service users, the registry includes utilization data for fee-for-service medical payments (MSP PIM), out-of-province physician services (MSP-OOP), hospital discharges for residents of British Columbia both in and out of province (HSP-DAD) and seniors' pharmaceutical use (PharmaCare). Utilization files were compared to the annual registry to identify non-registered individuals using these services. These non-registered service users accounted for an average of 0.5% to 1.5% of the total registry population per year.

Demographic information for each resident was identified, including age and sex (cumulative demographics file). The demographics file also identified individual resi-

dents who died during the year. Detailed checks were implemented to avoid double-counting of individuals, recognizing that people may re-register or change MSP premium payment sources over time.

Intermediate registry, demographic and utilization files were combined with data groupers as a means of categorizing individuals. These tools cluster individual-level data into groupings by home geographic area, socio-economic status and morbidity.

Geographic groupers used postal code data to categorize residents into home areas. The BC Stats Translation Master File (TMF) and Statistics Canada Postal Code Conversion File (PCCF) were used along with individual resident postal code data to group BC residents into home geographic areas. The BC Stats TMF was used to derive local health area, health service delivery area and health authority variables for individual residents. The Statistics Canada PCCF was used to derive federal geographic area measures. Data for home residential location are critical for defining geographic populations to calculate utilization, treatment prevalence and other population-based rates.

Home geographic area data were also used to derive proxy measures of socio-economic status. Individuals were grouped into neighbourhoods, and this information was combined with census neighbourhood income data to derive neighbourhood income quintiles and deciles as a proxy for individual socio-economic status.

Morbidity data for all individuals in the population research registry were derived using age and sex data from the cumulative demographics file and diagnosis data from payment (e.g., MSP-PIM) and services files (e.g., HSP-DAD). Morbidity categories were identified using the Johns Hopkins case-mix group tools: Adjusted Clinical Groups (ACGs), Aggregated Diagnosis Groups (ADGs) and Expanded Diagnosis Clusters (EDCs) (Johns Hopkins 2003). The ACG and EDC tools have been validated in Canada and have been used to estimate population health status, to develop risk adjustment measures and to study chronic health conditions (Reid et al. 1999; Reid et al. 2002; Broemeling et al. 2005). We used the registry data and case-mix tools to derive a summary morbidity measure and to identify the presence of specific conditions (e.g., diabetes, congestive heart failure), types of conditions (e.g., acute, chronic), service use categories (e.g., non-users) and co-morbidity categories based on the number of types of conditions experienced (none, low, medium, high, very high co-morbidity) for each individual in the population research registry. More detail on these morbidity measures is reported elsewhere (Broemeling et al. 2005).

As a result of linking administrative source files to create intermediate files – combined derived geographic, income and morbidity information – the population research registry provides integrated data in annual registry files for almost all BC residents. Annual files were created enabling longitudinal analyses. The 2003/04 population research registry contains anonymized individual-level data for 4.2 million British Columbians. Provincial population estimates for British Columbia for 2003/04 also

report 4.2 million residents (British Columbia 2007).

Unique scrambled identifiers protect privacy and ensure anonymity. Privacy and confidentiality requirements are strictly protected. Population research registry information is available for approved research projects, but all requests to use the data must be reviewed and approved by data stewards responsible for the information. Strict rules are applied for accessing information so that no individuals can be identified or their confidentiality compromised. In addition to privacy and data access review, researchers must apply for research ethics review and approval, report only aggregated results and submit research reports for review prior to release to ensure that confidentiality standards are strictly maintained.

## What Did We Learn?

The population research registry, along with physician information and utilization data, provides the foundation for studying the interactions between the population and providers, including the specific types of services used by individuals and delivered by providers.

In British Columbia, the creation of a population research registry was complicated by the collection of premiums for medical services plan registration. The province is one of a few in Canada collecting premiums for medical services coverage. The majority of individuals residing in British Columbia are registered with the provincial medical services plan, and they either pay their premiums themselves or have them paid on their behalf by employers or provincial or federal programs. However, premiums create a disincentive for some individuals to enrol with the medical services plan, resulting in incomplete data on provincial residents from the province's medical services plan registration file (MSP R&PB). Additional data were required to identify individuals in the population who were not registered with MSP. For the population research registry, we used service utilization data to identify individuals who used healthcare services but who were not registered with the provincial medical plan.

While the population research registry is as complete as possible using administrative data, it does not include individuals who have never registered with the provincial medical plan or used provincial healthcare services. At this point, no data are available to identify individuals living in the province who have never registered with the Medical Services Plan and who have not used publicly supported healthcare services, and we are thus unable to provide information on this population subgroup.

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**The population research registry enables system-level research and performance reporting for primary healthcare.**

The population research registry enables system-level research and performance reporting for PHC. The registry provides core information on population characteristics to describe the population of the province at a point in time or over time. It also allows us to identify and study the population according to age, sex, morbidity, chronic health conditions or geographic categories. The registry provides the denominator for analyses of population-based rates such as treatment prevalence rates for specific chronic health conditions. Annual registry files support temporal analyses of the population.

The population research registry differs from other data sources such as the Census, population forecasts, Vital Statistics and disease registries. As an example, disease registries have been developed to identify individuals with specific conditions, usually chronic health conditions. Registries such as the National Diabetes Surveillance System (Health Canada 2003) and provincial diabetes registries (British Columbia 2006) identify the subset of the population diagnosed with diabetes. In some provinces, these disease registries are used to assist physicians in identifying specific patients for chronic disease management.

On the other hand, the population research registry captures almost all residents of the province, irrespective of whether they have specific health conditions, along with information on whether they have been diagnosed as having specific conditions. This anonymized registry provides the foundation for undertaking population-based research, while disease registries focus only on individuals with specific conditions.

The population research registry also provides important information (e.g., age, sex, morbidity and registration status) that can be used to identify and study subgroups in the population. For example, the registry provides the foundation for identifying such groups as “high users” – the top 5% of medical service users (Reid et al. 2003). Grouping data from the population registry with service utilization data allows us to identify other high user categories, such as high users of hospital services or users of ambulatory care sensitive (ACS) condition hospitalizations, which should be minimized with primary care services (Billings 1996; MCHP 2005).

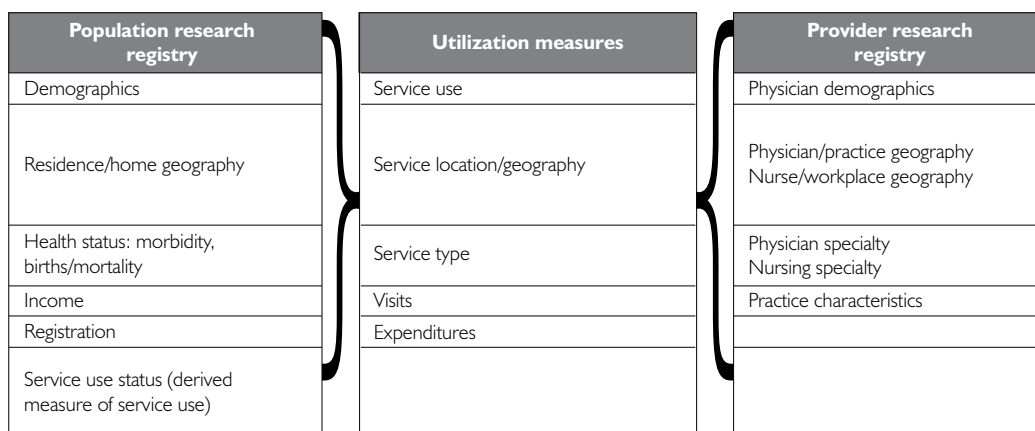
Not only does the population research registry provide data for the population, but it can be combined with anonymized provider data to enable analyses of service utilization and the interaction between BC residents and PHC providers. The population research registry complements a physician research registry (see Watson et al. 2009) to support measurement of service utilization such as the number and type of visits to PHC physicians by the population overall, by population subgroups (e.g., people with different patterns of morbidity) and over time.

Figure 2 describes the key measures that comprise the CHSPR Primary Care project, including the population research registry.

## What Are the Implications?

The value of the population research registry depends upon the quality and completeness of administrative data inputs to build the registry files. In recent years, an increasing proportion of medical services has been provided through alternative funding arrangements such as salaried physician services and sessional payments to physicians. These changes in funding arrangements have had an impact on the completeness of payment files (e.g., MSP-PIM) and, therefore, on diagnostic data available to support the accuracy of morbidity profiles in the population research registry. Therefore, the increasing proportion of physician services funded through alternative funding arrangements has had an impact on the completeness of not only utilization data to measure service encounters but also on the completeness of diagnostic data to identify morbidity levels in the population.

FIGURE 2. CHSPR Primary Care Project



It is unlikely that the increasing proportion of alternative funding arrangements has had a substantive impact on the total number of people identified in the research registry. The majority of individuals were identified using medical plan registration data, and historically, only 0.5% to 1.5% of the population has been identified using service utilization data. However, the main impact of increasing alternative funding arrangements has been to reduce information available for each individual in the registry, including morbidity, types of conditions and co-morbidity measures.

Moreover, the increasing proportion of alternative funding arrangements will have a differential impact on some population groups because these arrangements vary by service type and geographic area. For example, alternative funding arrangements account for an increasing proportion of paediatric, psychiatric, emergency and oncologic services (British Columbia 2003). Specific geographic areas are also affected as a

result of a higher proportion of alternative funding services in some geographic areas (Watson, Peterson et al. 2009).

Some jurisdictions have implemented data collection tools, such as shadow billing, along with alternative funding arrangements to ensure reporting of activity and individual patient–physician interactions and to avoid information loss (Ontario Ministry of Health and Long-Term Care 2005). In the absence of such data for British Columbia, the population research registry can be used to highlight these data issues and to focus analyses on geographic areas, age groups or services with more complete information.

Secondly, increasing concern for privacy of personal health information contributes to escalating complexity of research and evaluation activities in Canada (Black et al. 2005). On the one hand, there is recognition of the value of population research registries and data linkage to meet expectations for accountability, performance reporting, planning for service needs and health services research. Indeed, in many areas, there is recognition of the value of adding new data sources to enrich existing research data. Yet, there is also growing

concern about the use of personal health information, including non-consensual use required for population-based research. Furthermore, legislative and policy frameworks are not consistent across Canada, despite initiatives such as the proposed Health Information Privacy and Confidentiality Framework (Health Canada 2005).

It is a priority for future work in Canada to ensure consistent, comprehensive standards for use of health data that supports population-based research while ensuring security and protecting privacy and confidentiality of individual data. Recommendations have proposed the development of consistent best practice standards for use of health information and protection of privacy, including data stewardship, privacy toolkits and research ethics review standards (Black et al. 2005). This work is required to sustain and develop population research registries and information systems that are critical to health services research, performance reporting and accountability.

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**It is a priority for future work in Canada to ensure consistent, comprehensive standards for use of health data that supports population-based research while ensuring security and protecting privacy and confidentiality of individual data.**

## Conclusion

The BC population research registry at CHSPR provides a foundation for population-based PHC research, both at the population level and by subgroups within the population. This information, in turn, facilitates system-level performance measure-

ment and research on PHC. The BC population research registry provides a model for future PHC information systems and highlights the importance of complete data with which to study populations and their use of services.

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# Methods to Develop and Maintain a Valid Physician Registry in Evolving Information Environments

Méthodes pour la création et le maintien d'un registre de médecins dans le contexte évolutif de l'information



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## Abstract

*What did we do?* As the amount of alternative funding for physician services grows in Canada, the usefulness of fee-for-services (FFS) payment data as a source of population-based information declines. This paper describes methods used to develop and validate an anonymous registry of the physician workforce to support policy-relevant analyses in environments where doctors are increasingly funded through diverse arrangements.

*What did we learn?* Among the 8,558 physicians in clinical practice in British Columbia in 2004, 97% could be identified via FFS payment data. In 1996, 2000 and 2004, a similar number of physicians in clinical practice (N=340, 326, 290) did not submit FFS claims, and a stable proportion of these doctors (65%, 67%, 69%) could be identified using hospital discharge abstract data. Province-wide, local health areas varied in the proportion of total physicians' expenditures in 2004 attributable to FFS payments (0 to 100%).

*What are the implications?* FFS and hospital files could be used in tandem to identify physicians in clinical practice in order to create complete registries intended to support population-based workforce analyses. FFS and alternative funding payment files could be used together to calculate each physician's income and clinical activity, and to identify physicians for whom there is high likelihood of measurement error because they reside in local health areas where a large proportion of clinical activity is not captured.

*Recommendations:* Systems designed to track alternative funding should be uniformly structured within and across jurisdictions to maintain or increase the availability of population-based clinical data useful for secondary analyses. Only then can these data be used to support Canadian policy, management and clinical decision-making.

## Résumé

*Ce que nous avons fait :* Étant donné que les modes de financement pour les services médicaux se diversifient au Canada, la pertinence des données sur la rémunération à l'acte (RAA) comme source d'information démographique perd en importance. Cet article décrit les méthodes employées pour créer et valider un registre anonyme de l'effectif des médecins, afin de permettre des analyses politiques dans un contexte où la rémunération des médecins prend des formes de plus en plus diverses.

*Ce que nous avons appris :* Parmi les 8558 médecins qui travaillaient dans des cliniques en Colombie-Britannique, en 2004, 97 % pouvaient être retracés grâce aux données sur les RAA. En 1996, 2000 et 2004, un nombre semblable de médecins provenant de cliniques (N = 340, 326, 290) n'ont pas présenté de réclamations pour la RAA, et une

proportion stable de ces médecins (65 %, 67 %, 69 %) pouvait être retracée au moyen des données provenant du registre des sorties des hôpitaux. Dans la province, en 2004, les circonscriptions sanitaires variaient en proportion de la somme des dépenses pour les médecins attribuables à la RAA (de 0 à 100 %).

*Répercussions* : La RAA et les dossiers des hôpitaux peuvent être utilisés conjointement pour identifier les médecins en pratique clinique afin de créer des registres complets permettant des analyses démographiques de la main-d'œuvre. Les dossiers sur la RAA et sur les autres modes de financement peuvent être utilisés conjointement pour calculer les activités cliniques et le revenu de chaque médecin, et pour identifier les médecins pour lesquels il existe une forte marge d'erreur de mesure, puisqu'ils résident dans des circonscriptions sanitaires où une grande proportion des activités cliniques n'est pas consignée.

*Recommandations* : Les systèmes conçus pour retracer les divers modes de financement devraient être structurés de façon uniforme au sein des autorités et entre elles afin de maintenir ou d'accroître la disponibilité des données démographiques cliniques qui permettent d'effectuer des analyses secondaires. Ce n'est qu'alors que les données pourront être utilisées afin d'appuyer les politiques, la gestion et la prise de décisions cliniques au Canada.

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**H** EALTH HUMAN RESOURCES PLANNING, DEPLOYMENT AND EFFECTIVENESS have been identified as top priorities in national consultations intended to illuminate issues where new research and analysis could inform efforts to renew healthcare in Canada (CIHR and CHSRF 2008). Better information on the clinical activity of the healthcare workforce has been deemed necessary to inform the decisions, actions and policies of governments, as well as educational, regulatory and professional bodies.

Over the past decade, provincial fee-for-services (FFS) payment data have increasingly been used to understand the supply and distribution of physicians, patterns of practice among these providers and the use of their services by Canadians. These databases have proven particularly useful to profile trends in services delivered by physicians and received by patients. More recently, however, the validity of analyses based on FFS payment data have come into question, with growth in alternative (i.e., non-FFS) funding schemes and a lack of uniform standards to guide the establishment of new databases designed to track those payments or to support pooling of data from FFS and non-FFS payment files.

By 2003/04, the percentage of physicians who received some alternative funding from provincial ministry funders ranged from 7% in Alberta to 73% in Prince Edward

Island and Nova Scotia. Moreover, the percentage of clinical payments attributable to alternative funding ranged from 10% in Alberta to 42% in Newfoundland and Labrador (CIHI 2006). As the size of alternative funding for physician services grows in Canada, the usefulness of FFS payment files as a sole source of information on physician–patient encounters may be eroding.

FFS payment data can no longer be used in isolation to profile supply of physicians, practice patterns of the physician workforce or individual physicians if (a) a sizable proportion of doctors are no longer funded by governments with FFS, (b) doctors no longer receive a substantial share of their income from this source and (c) similar data structures are not available across FFS and alternative funding payment files to permit data pooling so as to ensure completeness of clinical service data for each physician. Thus, new approaches to designing population-based information systems are necessary in jurisdictions where physicians are increasingly funded through diverse arrangements.

An important first step to support valid, policy-relevant research and analyses in this evolving information environment is the creation of a valid physician registry that identifies the entire population of physicians as accurately and completely as possible, supports data linkage and pooling from an increasing array of sources and offers insights regarding the degree to which the data represent a complete account of clinical services (i.e., measurement error). While population-based registration information systems, such as those held by licensing bodies, can be used to identify the entire workforce, they cannot be used routinely as a registry to support data linkage. Additionally, the proliferation in the number and type of payment files reduces the likelihood that any one of them, such as FFS payment files, could be used as a registry.

This paper describes methods used to develop and validate an anonymized registry of physicians deemed to be delivering clinical services, illustrates how the registry can be used to estimate measurement error at the regional and physician levels and documents the degree to which increased use of alternative funding has altered capacity to count the physician workforce in clinical practice in British Columbia. While the existence, structure and composition of service and payment files varies across jurisdictions in Canada, the conceptual approach to the design of the anonymized registry and, to some extent, the methods used to create it should be useful to others to (a) assess the degree to which the completeness and accuracy of FFS payment files have (or have not) eroded with increases in alternative funding and the growth in databases used to describe physician services and (b) design a registry for use in this evolving information environment.

## What Did We Do?

In order to develop an anonymized registry of physicians delivering clinical services in 1996/97, 2000/01 and 2004/05, we used a two-stage process to identify doctors in British Columbia who appeared in one of a number of service or payment files,

and then calculated each physician's income by source of payment. The purpose of both stages was solely to create a registry of doctors deemed to be in clinical practice. A third stage was undertaken to determine the relative volume of physician services delivered to local health areas through block funding (i.e., annual budgets negotiated for a group of physicians). The purpose of this stage was to ensure that the registry included this information in order to enable analysts to calculate measurement error in physician-level estimates of income and clinical activity. This project was approved by the Ministry of Health Services, the College of Physicians and Surgeons of British Columbia (CPSBC) and an ethics committee at the University of British Columbia. More details regarding methods are described elsewhere (Watson et al. 2006).

To differentiate the types of electronic data files, we refer to *registration files*, which include information about people but not services or payments; *services files*, which record services delivered or received; and *payment files*, which record remuneration to individual physicians or provider organizations. The anonymized registry included registration files from CPSBC; Medical Services Plan Practitioner Files, which include physicians ever eligible to bill the Ministry of Health Services; payment files from the Medical Services Plan, reflecting FFS claims for physician services delivered to BC and out-of-province residents; service files, including those from the Hospital Discharge Abstract Database and from primary healthcare organizations that receive capitation funding; and payment files from the alternative payment program in British Columbia (APP-BC), which include data that can be attributed to specific physicians (e.g., salary, sessional payments, rural incentives) or organizations (i.e., block funding). (See Figure 1.)

## Stage 1

The foundation of the registry is a computer algorithm that was used to scan the CPSBC registration file and the Medical Services Plan Practitioner File to create a registry database that would include a parsimonious set of information (e.g., sex, date of birth, unique identifier, practice location) regarding physicians who met all the following criteria:

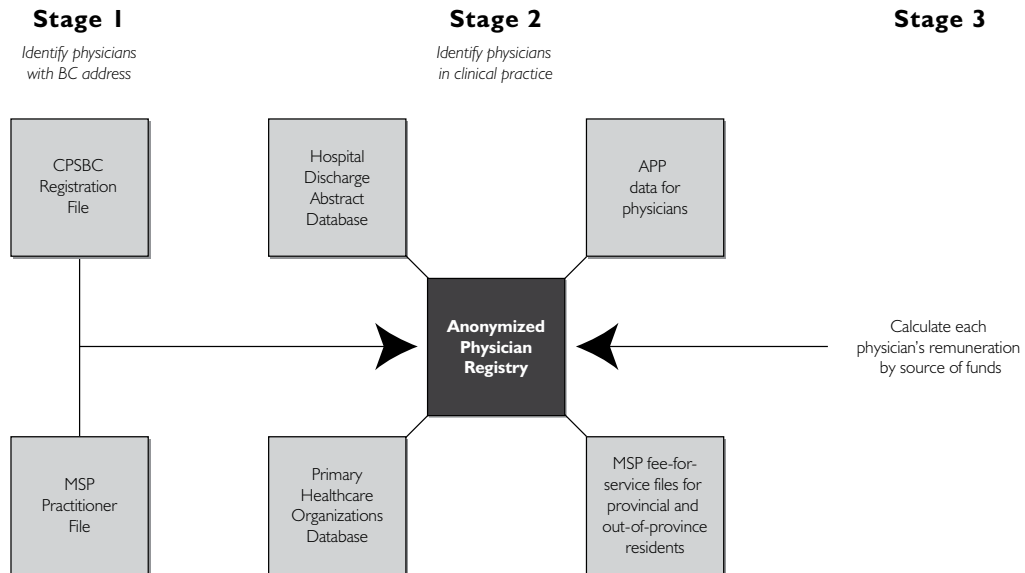
- eligible to bill the Medical Services Plan;
- registered with CPSBC; and
- resided in the province, as evidenced by a BC postal code, during a select fiscal period.

## Stage 2

To identify physicians who delivered clinical services and to calculate the amount of remuneration each physician received through FFS and alternative payments

attributed to specific physicians, we next created a computer algorithm to scan service files and payment files, as illustrated in Figure 1. The result is the identification of physicians who delivered clinical services, and for each doctor the total amount of FFS and alternative funding received over the period. Physicians' remuneration from organizations that receive block funding is not included, since it is not possible to determine which physicians receive funds from this source; the resultant measurement error regarding estimates of each physician's remuneration is addressed in Stage 3. Using any one file or subset of files listed in Figure 1 to count the number of physicians and measure their clinical activity would underestimate the population of doctors that deliver clinical services in British Columbia.

**FIGURE 1.** Data sources used to create an anonymous physician registry with a parsimonious set of variables to support policy-relevant research



Note: CPSBC = College of Physicians and Surgeons of British Columbia; MSP = Medical Services Plan; APP-BC = Alternative payment program data for physicians in British Columbia.

### Stage 3

The third stage of registry development is intended to create an estimate of measurement error, for each physician, regarding calculations of his or her income or clinical activity. This measurement error relates to the extent to which physicians' services delivered in their local health areas receive block funding – for example, to organizations that are responsible for delivering cancer care, diabetes care or mental health services through global budgets – where it is not possible to identify which physicians

have been remunerated with those funds.

This stage required the identification, for each local health area, of the proportion of total physician services attributable to block funding. This information was then included in the registry by creating a variable for each physician, to be used by analysts to identify doctors for whom payment data might be considered incomplete or biased. For example, a study regarding workloads among family physicians or the average number of patients seen by each might exclude doctors who reside in local health areas where 30% or more of primary care physician services are financed through block funding. In those regions, each family physician's clinical activity data derived from methods outlined in Stage 2 might underestimate the doctor's work, as it is not possible to determine which physician delivered services remunerated through block funding. Thus, all family physicians in the local health area would need to be excluded from the study to reduce estimation error. In essence, physicians should be excluded from analyses when they reside in areas where physician-level data are so incomplete that analyses based on their data would be considered biased.

## What Did We Learn?

The number of physicians who delivered clinical services in British Columbia and who were included in the anonymized registry was 7,534, 7,822 and 8,558 in 1996/97, 2000/01 and 2004/05, respectively. Among the 8,558 physicians in clinical practice in 2004, a full 97% (8,268 physicians) could be identified using MSP FFS payment file (Table 1); the remaining 3% (290 physicians) could be identified using other payment or service files (Table 2).

The exclusive use of FFS payment data significantly underestimates the number of physicians in clinical practice. Among the 3% or 290 physicians in clinical practice who could not be identified in the FFS payment files in 2004/05 (Table 2):

- 69% could be identified in service files from hospitals (N=199, of whom 25 physicians were also identified via the alternative payment program data); and
- 39% could be identified in APP-BC payment files (N=114, of whom 25 physicians were also identified via the Hospital Discharge Abstract Database).

In 1996/97, 2000/01 and 2004/05, a similar number of physicians in clinical practice (N=340, 326, 290) were unaccounted for using FFS payment files, and a similar proportion of them (65%, 67%, 69%) could be identified using the Hospital Discharge Abstract Database. What is unknown, however, is the number of physicians that are solely funded through block or capitation funding for which their services are not recorded in service files such as the Hospital Discharge Abstract Database or the PHC organization databases.

**TABLE 1.** Count of physicians who received Medical Service Plan fee-for-service payments, by database, 2004/05

MSP	Hosp	APP	PHCO	PTO	Total	%
✓					439	5%
✓	✓				239	3%
✓	✓	✓			131	2%
✓	✓	✓	✓		-	-
✓	✓	✓	✓	✓	16	0%
✓	✓	✓		✓	864	10%
✓	✓		✓		-	-
✓	✓		✓	✓	58	1%
✓	✓			✓	3,908	47%
✓		✓			159	2%
✓		✓	✓		1	0%
✓		✓	✓	✓	5	0%
✓		✓		✓	265	3%
✓			✓		2	0%
✓			✓	✓	10	0%
✓				✓	2,171	26%
					8,268	100%

Note: MSP = Medical Services Plan Fee-for-Services payment database for provincial residents; Hosp = Hospital Discharge Abstract Database; APP-BC = Alternative payment program data for physicians in British Columbia; PHCO = Primary healthcare organizations; PTO = Medical Services Plan Fee-for-Services payment database for out-of-province residents.

Tables 1 and 2 can be used in tandem to calculate the percentage of the physician workforce that could be captured with various combinations of payment and service files. For example, the creation of an anonymized registry through reliance on 2004/05 FFS and APP-BC payments would include 8,382 physicians (97.9% of physicians in clinical practice). A registry based on FFS and hospital files would include 8,467 physicians (98.9% of practising physicians); and a registry based on FFS, APP-BC and hospital files would include all but two of BC’s practising physicians.

Over the study period, the percentage of clinical payments attributable to alternative funding of all types in British Columbia increased from 8% in 1996 to 10% in 2004. Across the 89 local health areas in the province in 2004, alternative funding of all types accounted for 1 to 100% of total physician expenditures. Alternative funding was also not confined to rural and remote areas that have few physicians. For example,

these methods of funding represented 22% and 27% of total physician expenditures in the local health areas of Vancouver Midtown and Vancouver Downtown in 2004.

**TABLE 2.** Count of physicians who do not receive Medical Service Plan fee-for-service payments, by database, 2004/05

MSP	Hosp	APP	PHCO	PTO	Total	%
	✓				174	60%
	✓	✓			25	9%
	✓	✓	✓		-	-
	✓	✓	✓	✓	-	-
	✓		✓		-	-
	✓		✓	✓	-	-
	✓			✓	-	-
		✓			89	31%
		✓	✓		-	-
		✓	✓	✓	-	-
			✓		-	-
			✓	✓	-	-
				✓	2	1%
					290	100%

Note: MSP = Medical Services Plan Fee-for-Services payment database for provincial residents; Hosp = Hospital Discharge Abstract Database; APP-BC = Alternative payment program data for physicians in British Columbia; PHCO = Primary healthcare organizations; PTO = Medical Services Plan Fee-for-Services payment database for out-of-province residents.

Across BC local health areas in 2004, block funding accounted for 0 to 100% of total physician expenditures. Block funding was not confined solely to remote areas that have few physicians. For example, this block funding represented 69% of total physician expenditures in the local health area of Kootenay Lake in 2004. Given the absence of physician and patient identifiers in the database designed to track block funding for physician services in British Columbia, neither supply- nor patient-based analyses would be possible in this jurisdiction.

## What Are the Implications?

Between 1996/97 and 2004/05, there was an increase in the proportion of alternative funding to physicians in British Columbia and elsewhere in Canada. New databases

designed to track alternative funding have tended to result in loss of physician-, service- and patient-specific identifiers that were historically available in FFS payment files. While much has occurred in British Columbia and other jurisdictions in Canada since this project was undertaken, in response to growing awareness that lack of uniformity in data structures results in loss of analytic capacity, important implications from this work still hold true as efforts continue to redesign old information systems and design new ones.

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... lack of uniformity in data structures results in loss of analytic capacity ...

A complete registry of physicians in clinical practice now requires FFS and hospital data but is likely to underestimate community-based practice

In 2004/05, sole use of FFS payment files would have resulted in underestimates of the supply of physicians. At the moment, the problem is not big – at least in British Columbia. In 2004/05, 97% of the population of physicians in clinical practice could be identified using FFS payment files despite the fact that FFS accounted for 90% of total expenditures on physician services. Of the physicians who could not be identified with FFS payment files, 69% could be identified through the use of the Hospital Discharge Abstract Database. Similar findings were evident in 1996/97 and 2000/01. Thus, combined use of FFS and hospital files now offers an efficient means of improving estimates of physician supply in British Columbia.

Insofar as some community-based physicians are remunerated solely through block or capitation funding and receive no FFS income, the only databases useful for identifying them as active in clinical practice are service files. In British Columbia, the only service file available for community-based physicians as of 2004 was for those in the PHC organization program. This database includes services received by patients, and reporting relies on a claims system. The benefits of this arrangement include continued ability to track physicians who deliver clinical care, as well as collection of diagnostic and service information about the population served. This data strategy demonstrates the feasibility of collecting data about services from capitation-funded organizations through FFS infrastructure.

Community-based physicians who are remunerated solely through block funding, received no FFS and delivered care outside PHC organizations would not be identified using the methods outlined here. Importantly, following release of a review of the APP-BC in 2003, health authorities and agencies were required to submit service files similar to those used in the PHC organization program (Office of the Auditor General of British Columbia 2003, 2006).

The magnitude of underestimation in physician supply counts through methods that rely solely on traditional FFS payment data will become greater over time, insofar

as (a) a ministry increasingly uses block payments to purchase services and does not include these data in payment files or does not simultaneously require providers to track activity in a service file, and (b) physicians increasingly seek remuneration solely from service organizations that receive block or capitation payments. We know that at least the former situation is true. At the time of writing, we did not have any data from alternative funding for the Medical On-Call Availability Program or the Rural Practice Programs. The Canadian Institute for Health Information (2006) reports that these programs accounted for \$8 million, \$31 million and \$163 million in expenditures in 1996/97, 2000/01 and 2002/03, respectively.

### Support for high-quality analyses now requires information on the relative volume of services each physician delivers through FFS and alternative funding

Although there is little erosion in capacity to count doctors in British Columbia, given the growth in use of new databases to support increases in alternative payments, the fact that alternative funding has increased indicates that the proportion of physicians' income attributable to these sources is growing. As alternative payments increase, fewer physicians will be eligible for inclusion in studies that rely on information available solely in FFS payment files. In British Columbia, there are a number of local health areas in rural, remote and metropolitan areas for which FFS represents a small proportion of total expenditures on physician services. Importantly, the anonymous physician registry can be used to identify physicians to be included or excluded in studies on the basis of the type of data available for each of them or the magnitude of estimation error in areas that are block funded for which no shadow claims or service files exist.

Alternative funding payment files vary in the degree to which they can be used in tandem with FFS payment files to measure constructs important to planning, evaluation and policy. Alternative payment databases that include physician-specific information, such as salary and sessional payment data, tend to include the size of remuneration but no other service- or patient-specific information, including the diagnostic condition(s) responsible for the visit. These data can be combined with FFS payment data for the purposes of calculating workload metrics such as full-time equivalents, but cannot be combined with FFS payment files to measure other volume metrics, such as visits per annum.

Significantly, the physician registry described can be used to create valid study populations and to support valid measurement of clinical activity. For example, a study to count the number of family physicians and full-time equivalents in clinical practice

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... the physician registry described can be used to create valid study populations and to support valid measurement of clinical activity.

would rely on the registry to identify all doctors, irrespective of their source of funding. Without the registry, an analyst who relied solely on FFS payment files would underestimate the supply of physicians in a jurisdiction that used alternative funding. With the registry, physicians who receive all their income from block or capitation funding, for example, would be identified through the inclusion of service files. Analyses of the workloads of family physicians would rely on the registry to identify sources of income for each physician, and then pool data from appropriate payment files to calculate each physician's full-time equivalent. As another example, a study regarding the average number of patients seen by family physicians would rely on the registry to identify and exclude from analyses the doctors who receive 10% or more of their income from alternative funding when data associated with this method of payment do not include patient-level information.

### Population-based analyses require estimation of measurement error due to missing data

Alternative payment databases designed to support block funding tend to include, at least in British Columbia, data regarding the size of payment, the type of service (e.g., cancer care, diabetes care, mental health services) and the local health area in which the funded organization was located. No other provider- or patient-specific data are included. These payments, therefore, cannot be attributed to physicians or patients in order to support population-based analyses of supply or utilization. But the physician registry can be used to estimate measurement error in analyses based on data from physicians who reside in the jurisdiction.

The magnitude of estimation error for a geographic population of physicians or cohort of specialists or generalists will be directly related to the degree to which the proportion of total physician expenditures in a jurisdiction or to a specialist/generalist group is derived from block funding. The size of estimation error is highest when a high proportion of total physician expenditures in a jurisdiction or a specialist/generalist group are funded through block payments. Furthermore, the size of estimation error is highest when there are no service files to accompany block funding. This type of estimation error will vary by jurisdictions across Canada, depending on the degree to which block payments are used to fund physician services and the degree to which funders require shadow claims or use of service files to track clinical activity.

Failure to capture patient-specific data in alternative funding payment files introduces bias in population-based analyses of BC residents who rely on FFS payment data. The magnitude of estimation error for a geographic population or cohort of BC residents will be directly related to the likelihood that they received services from alternative-funded physicians (e.g., salaried physicians) or organizations (i.e., block or capitation payments). For example, the accuracy of estimates of visit rates to paediatric-

cians among a geographic population may be skewed if paediatric service organizations in their community receive block funding, or if the vast majority of paediatricians are funded through alternative payments. The anonymous physician registry cannot help estimate bias due to the former, but it can help with the latter.

## Conclusion

This paper outlines innovative methods used to aggregate a parsimonious set of data from all available sources and create an anonymized physician registry at a time marked by growth in alternative funding, an increase in the number of databases to track these funds and a decline in the completeness of FFS payment files in Canada. This type of registry offers the most valid source of information to support physician workforce research and analyses. It can be used to count physicians in clinical practice, create study cohorts to conduct policy-relevant analyses and estimate bias in provider-based analyses.

Because the responsibility for alternative funding programs tends to be spread across different units within health ministries and, in most jurisdictions, each administrative unit is responsible for setting its own information requirements, databases designed to support these payments vary within and among ministries of health; some include information about providers and patients and others do not (CIHI 2006). But new databases designed to track physicians' services funded through alternative funding programs typically include less information than is available in FFS payment data in Canada.

In the future, information systems to track these services should be uniformly structured within and across jurisdictions and retain or increase the array of data needed to support the creation of evidence demanded by healthcare policy, management and practice communities.

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# Supply and Distribution of Primary Healthcare Registered Nurses in British Columbia

Effectif et distribution des infirmières  
autorisées œuvrant dans les soins primaires  
en Colombie-Britannique



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## Abstract

*What did we do?* This study uses an existing data source to (a) describe the population and geographic distribution of registered nurses (RNs) working in primary healthcare (PHC) in British Columbia, (b) compare this workforce to PHC physicians and (c) assess the distribution of PHC-RNs relative to population health status.

*What did we learn?* Of the 27,570 practising RNs in British Columbia in 2000, there were 3,179 (12%) in the PHC workforce. This translates into 147 people per practising RN and 1,277 people per PHC-RN. In 2000, there were 990 people per PHC physician. PHC-RNs represented 43% of the combined PHC workforce of physicians and RNs. A large proportion (47%) of PHC-RNs worked in community health centres, whereas less than 2% worked in physicians' offices. Geographic distribution of PHC-RNs is similar to the distribution of PHC physicians and is not associated with population health status.

*What are the implications?* There seem to be sufficient PHC-RNs to implement policy objectives in support of interdisciplinary PHC teams, but physicians and nurses will increasingly need to practice in the same location or have access to electronic information systems to support coordination, continuity and comprehensiveness of PHC. The PHC workforce could be better deployed to align with population health status.

## Résumé

*Ce que nous avons fait :* Cette étude utilise une source existante de données pour (a) décrire la population et la distribution géographique des infirmières autorisées qui travaillent dans le contexte des soins de santé primaires (SSP) en Colombie-Britannique, (b) comparer cette main-d'œuvre avec celle des médecins qui œuvrent dans les SSP et (c) évaluer la distribution des infirmières autorisées en fonction de l'état de santé de la population.

*Ce que nous avons appris :* Parmi les 27 570 infirmières autorisées de la Colombie-Britannique en 2000, 3179 (12 %) travaillaient dans le secteur des SSP. Cela se traduit par 147 personnes pour chaque infirmière autorisée et 1277 personnes pour chaque infirmière autorisée œuvrant dans les SSP. En 2000, il y avait 990 personnes pour chaque médecin travaillant dans les SSP. Les infirmières autorisées œuvrant dans

les SSP représentaient 43 % de la main-d'œuvre des SSP, comprenant à la fois les infirmières et les médecins. Une grande proportion (47 %) des infirmières autorisées œuvrant dans les SSP travaillaient dans des centres de santé communautaire tandis que moins de 2 % travaillaient dans des cabinets de médecins. Dans le contexte des SSP, la distribution géographique des infirmières autorisées est semblable à celle des médecins et n'a pas de lien avec l'état de santé de la population.

*Répercussions* : Il semble y avoir, dans les SSP, suffisamment d'infirmières autorisées afin de réaliser les objectifs politiques d'appui aux équipes interdisciplinaires de SSP, mais les médecins et les infirmières devront de plus en plus travailler dans les mêmes lieux ou avoir accès à des systèmes d'information électronique afin d'assurer la coordination, la continuité et l'intégralité des SSP. Dans les SSP, la main-d'œuvre pourrait être mieux déployée afin de s'harmoniser avec l'état de santé de la population.

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**T**HE CANADIAN FEDERAL AND PROVINCIAL/TERRITORIAL GOVERNMENTS have channeled substantial investment into primary healthcare (PHC) renewal in an attempt to ensure that 50% of the population have 24-hour access, seven days a week to multidisciplinary PHC teams by 2011 (Government of Canada 2006a,b, 2007). In 2004, the First Ministers agreed to accelerate work on health human resources (HHR) planning and initiatives to ensure an appropriate mix and adequate supply of healthcare professionals. Since that time, jurisdictions have developed a pan-Canadian framework for HHR planning that takes population health needs into account in order to design more responsive health systems (Federal/Provincial/Territorial Advisory Committee 2005). By 2007, approximately 40% of adults in Canada reported having access to PHC teams of doctors, nurses and/or other health professionals and access is most common among individuals with two or more chronic conditions (Khan et al. 2008).

While more work is needed to develop appropriate theories and methods to assess the distribution of registered nurses (RNs) relative to population health needs and the provision of PHC, foundational work describing the aggregated supply, distribution and deployment of RNs has been completed (Birch et al. 2007; O'Brien-Pallas et al. 2003). Past research has described, for example, the supply and distribution of RNs by geographic location or by using the categories of age, employment and place of work separately (CIHI 2004, 2006). Yet, in the area of PHC, little is known about the relative number and distribution of RNs who work in this sector, the distribution of this workforce across geographic regions relative to population health status or the degree to which existing information systems can be used to describe the PHC-RN workforce.

The objectives of this study were to (a) describe the population and geographic

distribution of RNs who deliver PHC in British Columbia in the year prior to major investment to catalyze renewal of this sector, (b) compare the size of this workforce relative to PHC physicians in the province, (c) assess the distribution of this workforce relative to population health status and (d) draw conclusions regarding the usefulness of existing data sources in identifying these health professionals. The study parallels other work by our team to identify physicians that work in PHC, describe temporal shifts in solo and group practices and assess the distribution of this physician workforce relative to population health status (McKendry et al. 2006; Watson et al. 2006).

## What Did We Do?

We used RN registration data from fiscal year 2000 in order to identify PHC-RNs. Data from 2000 were used because these data (a) predate PHC renewal initiatives funded through the Primary Health Care Transition Fund (PHCTF) to create a baseline for comparison purposes and (b) permit comparison to and amalgamation with the most comprehensive and complete assessment of the size and distribution of the PHC physician workforce in British Columbia.

The RN registration data are self-reported and collected annually by the College of Registered Nurses of British Columbia (CRNBC; formerly the Registered Nurses Association of British Columbia). Registration data are collected on all practising and non-practising clinicians who use the title "RN" in British Columbia and include such demographic information as year of birth, sex, education, practice status and employment information. All RNs are asked to state their primary, secondary and tertiary employers, including the primary employer's address. Reporting of secondary and tertiary employers' addresses is optional. We obtained anonymous registration data from the data holdings at the Centre for Health Services Policy and Research after obtaining ethics approval from the University of British Columbia; permission to use the data was granted from CRNBC.

Based on consultation with CRNBC and a small panel of RNs consisting of two community health nurses, a nurse manager and a community health nurse researcher, four variables in the registration data were used to identify PHC-RNs: place of work, area of responsibility, position and work status.

*Place of work* included nursing station/outpost/nurse clinic; private nursing agency/private duty; business/industry/occupational health; self-employed/private practice; mental health centre; physician's office; home care agency; and public health agency/community health centre.

*Area of responsibility* included rehabilitation/occupational health; mental health; home care; emergency care; and community health. Community health nurses in British Columbia carry out public health activities such as immunizations, well-baby

care and health promotion. These RNs also provide PHC services such as wellness care (e.g., routine blood pressure checks, health education), home care and chronic disease management.

The following *positions* were identified as relevant because RNs who assumed these roles would have direct interactions with the public: consultant; staff nurse/home care/community nurse; office/occupational/industrial nurse; and manager/assistant manager/supervisor.

Only RNs indicating part-time and full-time *work status* were included; those working casually were excluded because it was not possible to determine how many hours were worked.

In order to understand the characteristics and geographic dispersion of the PHC-RN workforce, we described the demographic characteristics of this group and calculated crude ratios of provider-to-population and population-to-provider. Population estimates were derived using British Columbia Statistics PEOPLE 28 (BC Ministry of Labour and Citizens' Services 2003). These ratios are compared to the ratio of population to general practitioners, family physicians and specialists deemed to be working in the PHC sector (Watson et al. 2006).

We gathered information for each of 16 health service delivery areas (HSDAs) and the 89 local health areas (LHAs), except in areas where both the total number of practising RNs and the number of PHC-RNs were very low (i.e., fewer than five RNs). We assigned PHC-RNs to jurisdictions on the basis of the primary employer's work address. In cases where nurses had provided no work address, we used their home address instead. Counts of PHC-RNs were combined with counts of PHC physicians at the HSDA level to calculate crude supply ratios. We used head counts to estimate the stock of supply because full-time equivalents for the RN workforce were not available. We also calculated the ratio of PHC-RNs to PHC physicians at the HSDA level to examine how supply rates of these providers were distributed across the province.

In order to assess equity in the geographic distribution of PHC providers, we measured the association of the supply-to-population ratio relative to the health status of those who resided in the same HSDA. The age and sex standardized premature mortality rate (PMR) was used as the central measure of need for healthcare because it is a widely accepted indicator of population health status (Birch and Eyles 1991; Shi et al. 2005). PMR is highly correlated with other measures of health in British Columbia, including potential years of life lost (Pearson correlation coefficient: 0.95,  $p < 0.0001$ ), life expectancy (Pearson correlation coefficient:  $-0.94$ ,  $p < 0.0001$ ) and age-standardized mortality (Pearson correlation coefficient: 0.91,  $p < 0.0001$ ) (McGrail et al. 2004). Pearson correlation coefficients and scatter plots were used to assess and illustrate the degree of association between the distribution of PHC-RNs and PHC physicians relative to PMR.

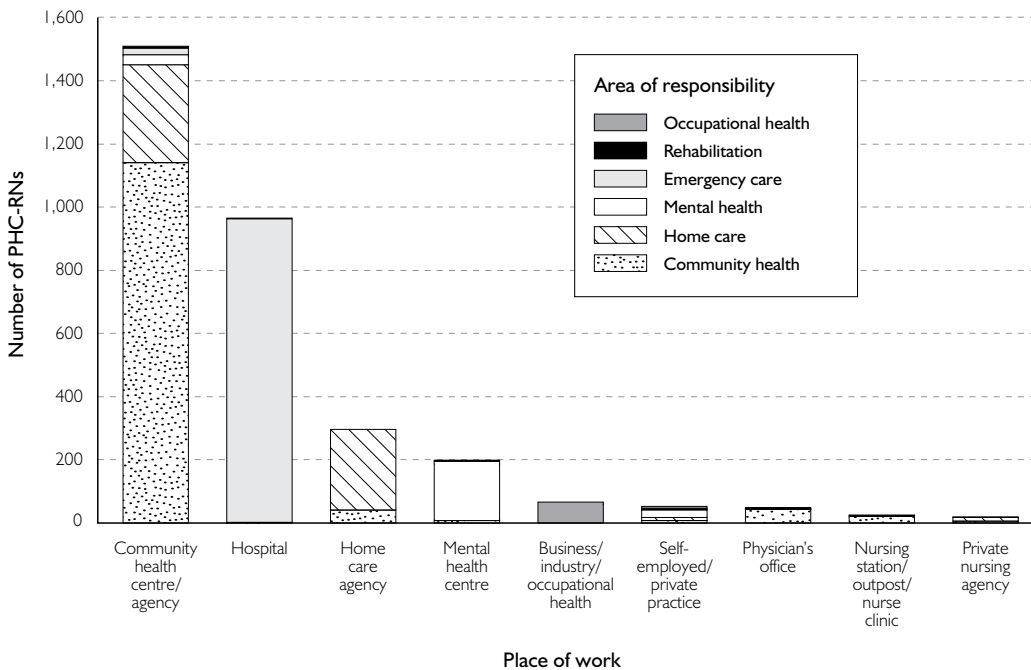
## What Did We Learn?

In 2000, 33,099 RNs were registered with the CRNBC and 27,570 (83%) of these RNs were practising. This equates to a total of 679 practising RNs per 100,000 or, conversely, a total of 147 people per practising RN. Eighty-one per cent of practising RNs reported their place of work as one of three settings: a hospital (n=17,265), a community health agency or centre (n=2,498) or a long-term care home (n=2,399).

We identified a total of 3,179 (12% of practising RNs) who met our eligibility criteria as working in the PHC sector. This equates to 78 per 100,000 population, or 1,277 people per PHC-RN. A large proportion (47%) of all PHC-RNs worked in community health centres, whereas less than 2% of all PHC-RNs worked in physicians' offices.

Almost three-quarters (74%) of PHC-RNs were either staff nurses employed in community health centres (n=1,395) or emergency rooms (n=962). A total of 13 staff nurses were employed in a physician's office. Figure 1 shows the PHC-RNs according to their place of work and area of responsibility; 44% were staff nurses providing either community health or home care services, another 30% were staff nurses providing emergency care in hospitals and less than 1% of PHC-RNs were staff nurses in physician offices.

FIGURE 1. PHC-RNs by place of work and area of responsibility



RN counts: (Registration Database (2000), CRNBC.)

We identified an additional 590 “possible PHC-RNs” who reported secondary employment in PHC. The distribution of place, position and area categories of “possible PHC-RNs” was similar to those of PHC-RNs. The largest proportion (n=183) of these potential PHC-RNs were staff nurses working in community health agencies providing either public health or home care services. Seventeen per cent were staff nurses working hospital emergency rooms, and 15% were staff nurses working in hospitals providing PHC services.

The majority of RNs working in PHC were female (96%) and between the ages of 40 to 59 years (70%). One-quarter were under 40 years; only 5% were 60 years and older. The median age of PHC-RNs was 46 years, one year older than all other practising RNs in British Columbia. Almost half (49%) worked full-time and 35% worked part-time in a PHC role for their primary employer. Across HSDAs, the PHC-RN to population ratio varied from a high of 119 per 100,000 in Kootenay Boundary to a low of 56 per 100,000 in Fraser South. Across LHAs this ratio varied from a high of 244 per 100,000 in Castlegar to a low of zero in Arrow Lakes.

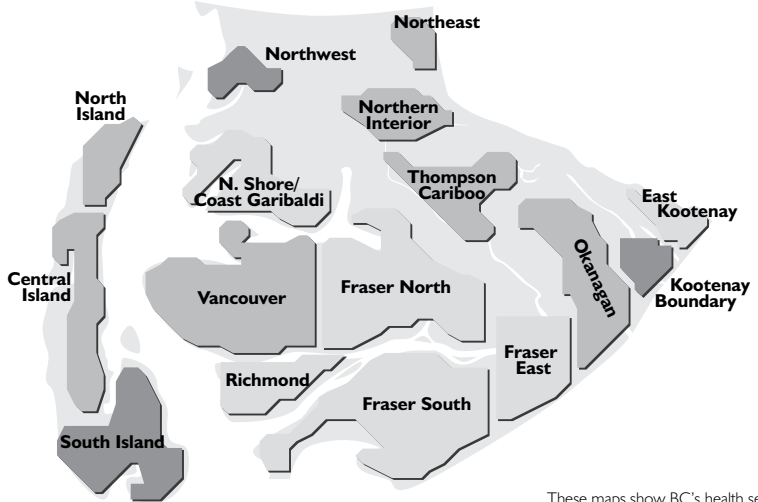
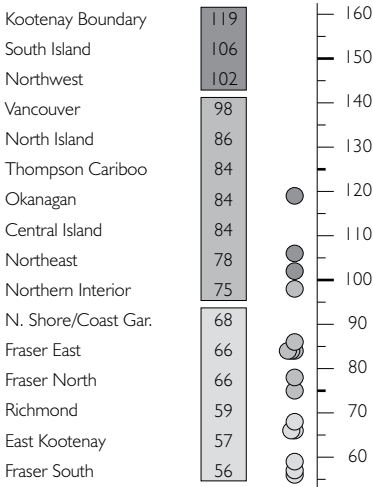
Combining counts of all RNs and physicians working in PHC in British Columbia in 2000 resulted in a crude ratio of 180 per 100,000 people. There was a twofold variation across HSDAs, with a high of 261 per 100,000 people in Vancouver to 125 per 100,000 in Fraser South. Figure 2 reveals some variation in the distribution of PHC-RNs per 100,000 population and more variation in the distribution of PHC physicians per 100,000 population. Regions reporting a relatively high ratio of PHC-RNs to population tended also to report a higher ratio of PHC physicians to population. The maps, or cartograms, in Figure 2 show British Columbia’s HSDAs proportionally sized by their populations instead of by the size of the geographic area.

Although PHC-RNs accounted for 12% of the RN workforce, they accounted for almost half (43%) of the combined PHC physician and PHC-RN workforce. Figure 3 shows that the percentage of the PHC-RNs of the combined PHC physician and RN workforce was similar across urban and rural regions.

If PHC providers were equitably distributed across the province according to population health status, we could expect that areas with low population health status (high PMR) would have a higher stock of providers to meet the areas’ additional needs. Conversely, areas with high population health status (low PMR) would have a lower stock of providers. That is, we would expect a significant positive association between measures of supply and PMR. Yet, we found no association between PHC-RN supply and British Columbians’ health status in 2000 (Pearson correlation coefficient: 0.48,  $p=0.06$ ). Communities with lower levels of health did not have more PHC-RNs, and communities with higher levels of health did not have fewer PHC-RNs. Figure 4 shows that that there was also no strong association between population health status and the combined stock of PHC-RN and PHC physicians (Pearson correlation coefficient: 0.33,  $p=0.21$ ).

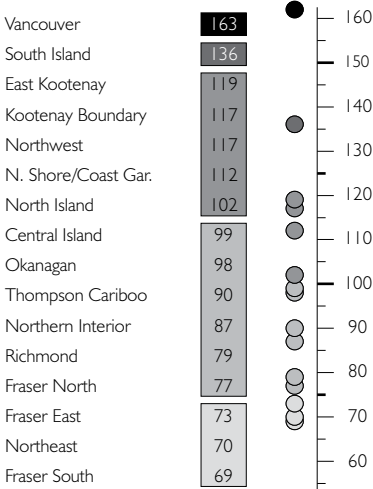
**FIGURE 2.** Variation in supply of PHC-RNs and PHC physicians by health service delivery area

Crude Ratio of PHC RNs per 100,000 Population  
2000



These maps show BC's health service delivery areas sized by their population instead of their area. Shape and contiguity are preserved as much as possible. An area the size of this square is equivalent to 2,000 people.

Crude Ratio of PHC Physicians per 100,000 Population  
2000/01



Data for both maps are classified into equal intervals as follows: <75, 75-99, 100-124, 125-149, 150+.

RN counts: Registration Database (2000), CRNBC.

Physician counts: MSP practitioner information file, MSP payment information master file (for fee-for-service data), hospital, primary healthcare organizations and alternative payments to physicians data, all BC Ministry of Health 2000/01 data; CPSBC (2000/01).

Population counts: PEOPLE 28 (2000), BC Stats.

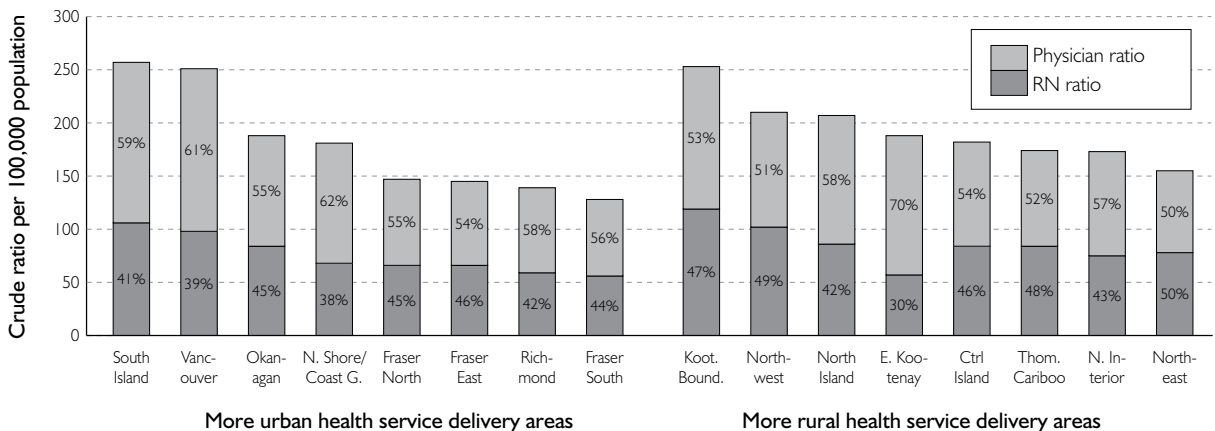
## What Are the Implications?

There were 27,570 practising RNs in British Columbia in 2000. Similar ratios of supply to population in this province have been reported by the Canadian Institute for

## Supply and Distribution of Primary Healthcare Registered Nurses in British Columbia

Health Information (CIHI 2001). We now know that PHC-RNs represent approximately 12% of the total supply of practising RNs, and that the proportion of PHC-RNs in British Columbia appears similar to that in Ontario, as estimated in a recent research project (Moira Stewart, Director, Centre for Studies in Family Medicine, personal communication, October 2006). More recently, we undertook similar work to calculate the size and geographic distribution of practising RN and PHC-RNs workforce in 2006. The proportion of PHC-RNs remains relatively unchanged, despite substantive increases in the RN workforce between 2000 and 2006 (Watson et al. 2009).

**FIGURE 3.** Combined ratios of PHC-RNs and PHC physicians by health service delivery area and by approximate urban/rural status



RN counts: Registration Database (2000), CRNBC.

Physician counts: MSP practitioner information file, MSP payment information master file (for fee for service data), hospital, primary healthcare organizations and alternative payments to physicians data, all BC Ministry of Health 2000/01 data; CPSBC (2000/01).

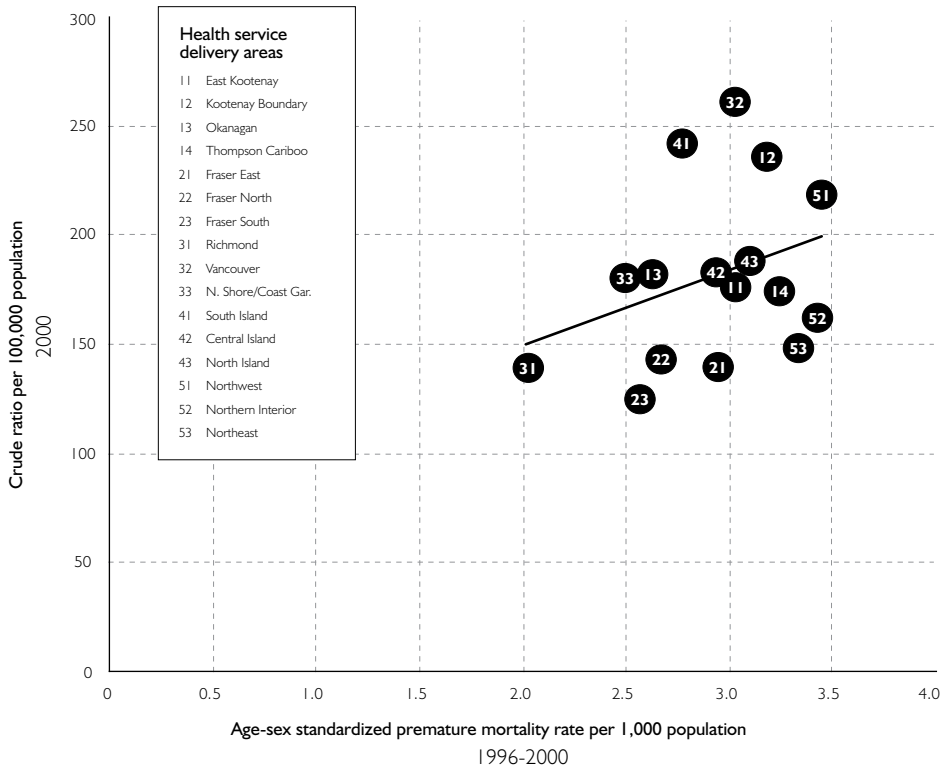
Population counts: PEOPLE 28 (2000), BC Stats.

If 12% of all 232,000 RNs across Canada in 2000 (CIHI 2001) worked in PHC, there would be 76 PHC-RNs per 100,000 population, or 1,327 people per PHC-RN. In British Columbia, this level of supply translates into 1,277 people per PHC-RN, suggesting a relatively higher level of supply than elsewhere in Canada due to the higher number of practising RNs to population in British Columbia.

By comparison, the supply of PHC physicians in British Columbia was slightly higher than that of PHC-RNs, at 101 per 100,000 or 990 people per PHC physician (Watson et al. 2006). These results suggest a level of supply (approximately one PHC-RN and one physician per 1,000 people) that has face validity of sufficiency in terms of the number active in provision of PHC. Clearly, work is needed to determine the extent of a shortage or surplus in the supply of healthcare providers who work in

the PHC sector, and the factors influencing perceptions of workforce sufficiency.

**FIGURE 4.** Combined ratio of PHC-RNs and PHC physicians by premature mortality rate



RN counts: Registration Database (2000), CRNBC.  
 Physician counts: MSP practitioner information file, MSP payment information master file (for fee-for-service data), hospital, primary healthcare organizations and alternative payments to physicians data, all BC Ministry of Health 2000/01 data; CPSBC (2000/01).  
 Population counts: PEOPLE 28 (2000), BC Stats.

We contribute to the HHR planning agenda by offering new evidence regarding the number of RNs currently working in PHC, the proportion active in the provision of PHC and the geographic distribution of these providers relative to population health status. Needs-based planning for this sector will require more research to assess the productivity of this PHC workforce, as well as factors (e.g., organization of care) that influence production, utilization, effectiveness and efficiency (Birch et al. 2007).

Our findings offer insights regarding the organization of care relative to public policy objectives to improve access and quality of PHC, and ultimately population health status, through increases in use of multidisciplinary teams. Importantly, most PHC-RNs (47%) worked at community health centres in 2000, but only 3.9% of general practitioners and family physicians in British Columbia reported such locations as their main practice setting in 2001 (College of Family Physicians of Canada 2001). Conversely, few PHC-RNs (2%) worked in physicians' offices in 2000, while 83% of

general practitioners and family physicians in British Columbia reported this location as their main practice setting in 2001. These data suggest that PHC physicians and RNs tend to deliver services in different workplace settings to different patients. Indeed, the national work by MacLeod and colleagues (2004) suggests that many PHC-RNs working in rural and remote Canada work alone or with little back-up in their everyday practice. There is less empirical evidence about the extent to which patient care is coordinated or delivered by both PHC-RNs and physicians in more urban areas of British Columbia. Insofar as co-location is a precondition to multidisciplinary collaborative practice, particularly when electronic information systems that enable teams to transcend geography are relatively rare in Canada (Schoen et al. 2006), much could be done to improve the organization and location of providers and support teams that collaborate to meet population needs. PHC teams improve processes of care, reduce emergency room use, reduce risk of hospitalization and enhance confidence in the healthcare system (Barrett et al. 2008; Khan et al. 2008).

We determined that the geographic distribution of PHC-RNs does not optimally align with population health status. Our metric of supply-to-population ratio presumes that providers deliver care to populations that reside in the same location. Previous work by our team documents disparities in geographic distribution of PHC physicians in British Columbia but reports equity in the utilization of PHC physician services (Watson et al. 2005). In combination, these results suggest that patients or PHC physicians (or both) move across jurisdictional boundaries to obtain or deliver needed PHC services. The same could be true with regard to PHC-RNs. The degree to which patients or RNs move across boundaries to receive or deliver PHC services will remain unknown until information systems are designed to link PHC-RN services to the health status of their patients.

It is important to acknowledge that population-based administrative data sources are not sufficiently developed to describe the degree to which RNs or physicians deliver all core functions of PHC – first-contact care and services considered to be responsive, comprehensive, continuous and coordinated. Although some studies have described the work of PHC-RNs (Andrews et al. 2005; Clarke and Mass 1998; Wong et al. 2006), more work is needed to examine the degree to which PHC-RNs are involved in delivering the core functions of PHC or enacting the principles of PHC across geographic regions. This aim could be accomplished through additional analyses of college registration data, future inclusion of questions addressing nursing roles and functions on college registration forms or both. Alternatively, questions could be included in provincial or nationwide surveys of nurses to determine the degree to which they engage in delivering PHC services.

Our study should be interpreted in light of its limitations. Specifically, the methods we developed to identify PHC-RNs did not include all RNs who deliver some PHC services as a portion of their day-to-day work. The result of this type of meas-

urement error is that we underestimate the quantity of PHC services delivered by PHC-RNs. Next, geographic-based analyses rely on the completeness and accuracy of self-reported data regarding primary employer location. The data included more than one address, depending on the number of employers, for each RN. Thus the challenge was to situate each RN within a geographic location where she or he delivers most PHC services, despite the fact that some RNs work at more than one geographic region. This type of measurement error is likely to be random in urban or rural areas and, therefore, should not bias estimates of equity in distribution relative to population need. Lastly, definitive conclusions about causal relationships between geographic distribution of the PHC-RN workforce and population health status cannot be made because of the cross-sectional study design.

## Recommendations

This study provides baseline information about the supply and distribution of PHC-RNs working in British Columbia using newly developed methods that can be applied to current data and in other jurisdictions. Further research is needed to examine the nature of PHC-RNs' practice, determine whether there is a shortage or surplus of PHC-RNs, and consider how PHC services might be better organized so that providers can work collaboratively in the same settings towards improving access and quality and optimally aligning with population needs. Indeed, policy and planning activities related to PHC will require more up-to-date information that includes other health professionals (e.g., nurse practitioners, nutritionists, dentists, social workers, pharmacists) who work in this sector.

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Conclusions are those of the authors and reflect no official endorsement by MSFHR, the NIA or the CRNBC.

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# 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.

## 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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**I**N 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](http://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](http://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 longitudinal experiences with healthcare, as well as their short- or long-term outcomes. 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 PHC providers (e.g., people with chronic conditions). The challenge is to establish an operational definition of a PHC organization, identify a sample frame and recruit organizations and providers within them.

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

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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 completed surveys to share their experiences with general practitioners, health centres and dentists ([www.cqc.org.uk](http://www.cqc.org.uk)).

### Hybrid survey data structure: Follow patients, find providers

Another hybrid approach is to recruit a representative sample of Canadians and measure 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](http://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

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.

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

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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