Equity, Poverty, and Access – Canada

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Overview

This paper introduces medical workforce planners to the recent literature on access to physician services in Canada and explores how the literature on equity in access to health care can inform medical workforce planning. We proceed with the review by categorizing the equity literature according to three methodological approaches: (1) measuring access problems directly, (2) measuring access against clinical care standards or guidelines, and (3) measuring access by examining utilization relative to need. Our review shows that whatever measurement approaches one uses, we should be concerned about inequity in access to physician services in Canada, especially around specialist services. In addition, while we cannot reconcile all differences in study results that we review, the methodological perspective we offer is useful for a systematic understanding of this prolific field of research. We conclude the paper with implications of the equity literature for workforce planning. Our recommendations for workforce planners include: (1) workforce planning should be based on need, (2) workforce planning should routinely incorporate measures of inequity, and (3) workforce planning should play a major role in gathering and using evidence on why inequity exists.

Background

The fundamental goal of medical workforce planning is to promote access to timely, quality health care through the deployment of the appropriate volume and mix of medical human resources to ensure equal access for equal health care need (Advisory Committee on Health Delivery and Human Resources, 2005). Implicit in this goal is the principle of equitable access. It is thus logical to expect that research and policy in medical workforce planning go hand-in-hand with those in equitable access to care. Curiously, however, these two fields have largely developed in parallel with little interaction, and it is only recently that these two areas are coming together with the increased focus on need-based approaches to medical workforce planning.

In the workforce planning literature, it has been common practice to use current health care utilization as the basis for measuring service requirements, and the current number of providers as the basis for determining the number needed to meet those requirements (Birch, Kephart, Tomblin-Murphy, O'Brien-Pallas, Alder, & MacKenzie, 2007; O'Brien-Pallas, Baumann, Donner, Tomblin-Murphy, Gerlach, & Luba, 2001; Verhulst, Forrest, & McFadden, 2007). Population-provider ratios, which continue to be widely popular, are a basic and crude form of this approach. Provider-population ratios count the number of providers relative to the number of people in a population without taking into account variations in health care need across population subgroups, changes in population need, the degree to which the need of the population are currently being met, or whether current provider supplies are adequate to meet those need. More sophisticated workforce planning approaches in use and under development strive for refinements (Canadian Medical Association, 2004; Newton & Buske, 1998; Ryten, 1997; Shipman, Lurie, & Goodman, 2004; Verhulst et al., 2007). Ideally, workforce planning should recognize that need varies across population subgroups (e.g., age and sex); that need within population subgroups is changing over time (e.g., health status at any given age is changing); that the number, type and mix of services required to meet need will change over time (e.g., as a result of new technologies and service delivery models); and that the number of providers required to provide needed services may change as a result of changing productivity and workloads (Advisory Committee on Health Delivery and Human Resources, 2005; Birch et al., 2007). Nevertheless, the use of *observed* healthcare utilization data as the basis for

determining level of service requirements remains a fundamental component of nearly all approaches to workforce planning, regardless of their level of sophistication.

Observed utilization *per se*, however, cannot tell us the level of health care need or whether inequity in health care exists, because it reflects many factors other than need for health care. For example, health care may be over-utilized due to supplier-induced demand, or where patients demand health care that they do not really need. Health care may be, on the other hand, under-utilized because of access problems, such as shortage in supply of health professionals or long wait lists. Historical patterns of use and variations in practice patterns also influence the current health care utilization.

At the most fundamental level, the significance of the literature on access and equity in health care for workforce planning is that it questions the degree to which current patterns of utilization reflect need. Moreover, it examines the reasons for inequitable access and utilization, many of which are health human resource issues.

This paper reviews the literature on the access to physician services in Canada and explores how it can inform medical workforce planning. We focus on physician services for two reasons. First, physician services play a central role in medical workforce planning. Second, all physician services deemed medically necessary in Canada are governed by the Canada Health Act (1985) and offered universally to Canadians with no charge at the point of service. The Canada Health Act, established in 1984, sets criteria of public administration, comprehensiveness, universality, portability, and accessibility, and aims to remove financial or other barriers to access to medically necessary services. As our review will show, despite the Canada Health Act, inequity in access to physician services still exists in Canada. Accordingly, by focusing on physician services, we will be able to show the importance of incorporating research of equitable access in medical workforce planning even in a health care sector that one would expect offers equitable access.

Search Strategy and Terminology

We include 53 studies in our review identified through multiple search methods, including electronic databases, hand-searches of selected journals, and snowballing by checking references of selected studies (see Appendix 1 for detailed explanation of the search strategy). Our review focuses on studies since 1990, and readers should refer to Birch and Abelson (1993) for a comprehensive review of the Canadian literature on equity in health care in the1970s and 1980s. We review provincial or Canadian studies because the vast majority of studies fall into either of these geographic jurisdictions. In addition, our review concentrates on quantitative studies on the subject because we wish to contribute to the understanding of the current literature from a quantitative, methodological perspective.

Before proceeding, clarification regarding terminology is in order. When examining equity in health care, one should pay attention to different dimensions: equity in access to, utilization (or use) of, and quality of health care (Asada, 2008). Metaphorically, the access dimension concerns whether the patient reaches, or has opportunity to reach, the door of the health care provider or the facility, while the utilization and quality dimensions are concerned about what happens, or would happen, within the office of the health care provider or the health care facility. Utilization generally refers to quantity or types of services, and quality includes appropriateness of services. These are progressively demanding dimensions; without access there is no utilization, and without utilization, there is no quality. Yet equity in one dimension does not guarantee equity in another. There may be, for example, inequitable quality of health care among

those who have equitable access. While important, researchers rarely distinguish these dimensions in empirical analyses. We will consider literature that examines all of these dimensions.

Research Questions

Overview of recent research in the area

Studies examining equity in physician service use in Canada vary considerably in terms of measurement approaches, types of health services, "equity stratifiers" (i.e., characteristics examined in relation to equity), data sources, and analytical methods (Table 1). For example, while some studies look at overall physician services, other studies focus on services provided by specific specialties of physicians (e.g., general practitioners and specialists) or particular services provided by them (e.g., immediate care, specialized cardiovascular care, or screening procedures). Given its broad scope and complexity, this review does not comprehensively cover the equity literature on particular specialties or services. Still, we do draw some examples from this literature, and much of what we discuss is pertinent to that literature as well. The equity stratifiers most often investigated are income and education. Despite their well-recognized importance, only a handful studies have examined immigration status, visible minority status, aboriginal status, or geography as equity stratifiers.

Although these variations make straightforward comparison of studies difficult, the recent literature clearly suggests that inequity in the use of physician services still exists in Canada a quarter century after the implementation of the Canada Health Act. To understand further where inequity occurs in delivery of physician services in Canada, we classify the literature according to the different methodological approaches used. Each of these distinct approaches offers unique insights and perspectives on inequity. Moreover, consideration of these approaches offers guidance as to how the equity literature can inform workforce planning.

Methods and data sources used in the area

The measurement approaches employed in the equity literature can be grouped into the following three categories: (1) measuring access problems directly, (2) measuring access against clinical care standards or guidelines, or (3) measuring access by examining utilization relative to need. Tables 1 and 2 summarize differences in their application and key characteristics, which we will elaborate below.

(1) Measuring access problems directly

The first approach, directly measuring access problems, is arguably the most intuitive among the three approaches. Researchers, for example, can ask people whether they had problems accessing health care when they thought they needed it, or measure the length of wait lists for certain services. Researchers taking the first approach most often use health surveys of people – health care users and potential health care users – such as the Canadian Community Health Survey, the National Population Health Survey, and the Joint Canada/US Survey of Health. By directly asking people about access problems, researchers can examine *potential* access problems that would be invisible if they focused only on those who actually used health care (often termed *realized* access) (Sanmartin & Ross, 2006).

Some of these surveys, for example, ask respondents whether they have experienced unmet need (for example, the Canadian Community Health Survey asks, "… was there a time in the past year you felt you needed care but did not receive it?") and researchers examine whether the reporting of unmet need

is associated with equity stratifiers. Compared to their counterparts, unmet need is reported more often among people with lower income (Lasser, Himmelstein, & Woolhandler, 2006; Wilson & Rosenberg, 2004), lower education level, and no job (Wilson & Rosenberg, 2004), and among those in disadvantaged neighbourhoods (after adjusting for demographic, socioeconomic, and health status at the individual level) (Law, Wilson, Eyles, Elliott, Jerrett, Moffat et al., 2005). The reporting of unmet need, on the other hand, is not associated with immigration status (Chen, Ng, & Wilkins, 1996; Lasser et al., 2006).

Similar analyses have been conducted with a survey question regarding whether the respondent has a regular medical doctor. Compared to native born Canadians, immigrants are less likely to have a regular medical doctor (Chen et al., 1996; Lasser et al., 2006; McDonald & Kennedy, 2004; Talbot, Fuller-Thomson, Tudiver, Habib, & McIsaac, 2001), but they become indistinguishable from native born Canadians after 6-8 years in Canada (McDonald & Kennedy, 2004). Lasser et al. (2006) found that people with higher income are more likely to have a regular medical doctor than people with lower income. In addition, Sanmartin and Ross (2006) examined difficulties in accessing routine and immediate care. They found that people with lower education and with a full time job are more likely to report difficulty in accessing routine care than their counterparts, while people living in rural areas, having immigrated, and having less than high school are more likely to report difficulty in accessing immediate care.

Questions regarding unmet need, having a regular medical doctor, and routine and immediate care are usually directed at current or potential health care users, but researchers can also measure access through surveys of health care providers. For example, on-going physician surveys, such as the 2001 Janus Survey (The College of Family Physicians of Canada, 2007) and the 2004 and 2007 National Physician Surveys (National Physician Survey, 2006a, b), ask providers questions regarding patients' access problems. The target sample of the Janus Survey is all general practitioners in Canada, and that of the National Physician Survey is all general practitioners and specialists in Canada. According to these surveys, for example, overall proportionally fewer physicians were accepting new patients in 2004 (20.2%) than 2001 (23.7%). The proportion was virtually unchanged among rural physicians (33.8% in 2001 and 33.7% in 2004), while it declined among urban physicians (21.3% in 2001 and 18.1% in 2004) (Canadian Institute for Health Information, 2005). Alter and his colleagues (1998) conducted a more sophisticated survey of a representative sample of physicians and hospital administrators in Ontario and asked about their beliefs or experience in preferential access to specialized cardiovascular care. They found that 80% of physicians and 53% of administrators have personal experience in preferential access beyond patients' need, and according to them, characteristics such as having personal ties with the treating physician and being high-profile public figures or politicians are associated with preferential access.

As an alternative to obtaining subjective opinions on access from patients or providers, more "objective" indicators are available. Waiting lists or measures of waiting time are one example (Willcox, Seddon, Dunn, Tudor, Pearse, & Tu, 2007). Wait list indicators can be constructed from administrative data, management information systems, or databases expressly constructed to measure and monitor wait lists. For example, using the administrative data of over 50,000 patients with myocardial infarction in Ontario, Alter and his colleagues obtained information on the number of days from the hospital admission to the date of angiography and from the date of angiography to the date of revascularization (Alter, Naylor, Austin, & Tu, 1999). Using these numbers of days as surrogates for wait times, they found that the lower

the neighbourhood income of the patient was the longer the wait time for angiography was. However, waitlists are of somewhat limited utility for general studies of equity in physician care. They are not uniformly available, making comparative analyses difficult, and pertain to a specific type of care of procedures or care.

   The obvious attractiveness of this first approach, measuring access problems directly, is an intuitive interpretation of access problems it offers. This first approach, however, faces two crucial issues. First, it only captures data from those whose need for health care has been identified. People, for example, who did not have any access to health care for whatever reasons would never show up in wait lists, and people would not identify their unmet need if, to begin, they did not recognize or acknowledge it. Even when their symptoms or risk factors, such as high blood pressure or high body mass index, suggest that they should be accessing health care, they may not recognize the need to seek care or feel that seeking care would have value. A second critical issue with this approach is that people could identify access problems for care that is not needed, or which would be inappropriate. For example, patients may be concerned that they did not receive an antibiotic to treat a common, viral upper respiratory infection. Indeed, direct measures often measure unmet demand for healthcare, which may not be the same as unmet need. A study by Alter, Iron, Austin, & Naylor (2004) underscores this point. In a longitudinal study of over 2000 patients who received care for acute myocardial infarction in Ontario, Alter and his colleagues found that people with higher socioeconomic status were more likely to have coronary angiography, receive cardiac rehabilitation, and be followed up by a cardiologist, while their morality outcome one year after hospitalization was no better. However, they were more likely to be dissatisfied with their access to specialty care than their counterparts.

Thus, identifying the reasons for unmet need is crucial in measuring access directly. In surveys such as the Canadian Community Health Survey, respondents who indicate that they did not have their needs met are asked the reasons why (e.g., costs, time, inconvenience, and preference). Some of these reasons are personal, while others may be system related. To inform policy and planning, it is critical to take into account different expectation for care and distinguish access problems due to system reasons from those due to personal reasons. To our knowledge, no studies have taken these critical adjustments.

(2) Measuring access against clinical care standards or guidelines

The second methodological approach is based on comparisons of observed utilization against *a standard* of health care use that specifies how much and what kind of health care should be used given a level of need. This is difficult to accomplish for studying equity generally, as defining needed and appropriate care across a broad range of health services used by the population is challenging. Ideally, a standard should be determined based on evidence and informed by best practices and benchmarks. For many areas of care, there is sufficient and clear evidence on the effectiveness of approaches or treatments, along with consensus on corresponding standards of care. For a subset of these areas, there exist data and measures that enable assessment of the degree to which patients are receiving care according to that standard. When these conditions are met, one can use this second approach to measure equitable access. For example, clinical guidelines for various screening suggest the frequency and interval with which a particular screening should be offered for a certain population defined by, for example, age group. One could identify who is not meeting the recommendations of clinical guidelines and use this information for whether or not inequity in access to care exists. The second approach, thus, focuses on the dimension of quality of care.

Taking this second measurement approach, researchers have examined access to care or inequity in access to care in a broad range of clinical areas from screening, preventative care, use of prescription drugs to surgical care. A full review of this literature is well beyond the scope of this paper, and reaching global conclusions about equitable access from this literature is not possible. Examples of investigation using the second measurement approach include, in the area of primary prevention, uptake of Pap smear (Katz & Hofer, 1994; Lee, Parsons, & Gentleman, 1998; Quan, Fong, Coster, Wang, Musto, Noseworthy et al., 2006) clinical breast exam (Katz & Hofer, 1994), mammogram (Gentleman & Lee, 1997; Quan et al., 2006), the prostate specific antigen test (Quan et al., 2006), and influenza vaccination (Kwong, Rosella, & Johansen, 2007). All examinations limited study populations according to respective clinical guidelines, for example, whether women aged 18-74 years old had Pap smear in the past 2 years (Katz & Hofer, 1994) or whether men aged 40 years or over have ever received a prostate specific antigen test (Quan et al., 2006). Equity stratifiers examined are income (Katz & Hofer, 1994; Kwong et al., 2007; Lee et al., 1998), education (Gentleman & Lee, 1997; Lee et al., 1998), visible minority status (Quan et al., 2006), and immigration status (Lee et al., 1998). Remarkably but not surprisingly, all of these studies suggested greater uptake of these services by the pro-advantaged; people with higher income and education, Whites, and native born Canadians are more likely to meet clinical guidelines.

This second approach, using a standard, is the most evidence-based among the three approaches to measure equitable access to health care. Indeed, this second approach is the only approach that is primarily concerned about equity in quality of health care rather than merely access to or utilization of health care. For at least four reasons, however, this approach faces significant challenges. First, evidence is often lacking in many of the health care approaches and procedures. Second, even when evidence exists, there is often a lack of consensus about issues such as which treatment should be employed and under what conditions. Third, even when an evidence-based consensus exists, more often than not there are insufficient data and measurement tools to adequately assess the degree to which standards are being met in the population.

Finally, since clinical guidelines are often established for a certain procedure or a course of treatments for a specific condition, this approach can rarely offer an overall picture of equitable access (for example, does inequity exist in the access to general practitioner services on the whole as opposed to the uptake of Pap smear?). For broad applicability, this approach needs expansion as we see in the recent development in quality indicators. For example, researchers have used hospital admissions with ambulatory care sensitive conditions as indicators of inadequate access to quality primary health care (L. L. Roos, Walld, Uhanova, & Bond, 2005; Shah, Gunraj, & Hux, 2003). Effective quality primacy health care should be able to manage these ambulatory care-sensitive conditions, and hospitalization for these conditions should not be required. More generally, researchers seeking to evaluate care delivery models in primary care and for common chronic diseases are making considerable progress in amassing data and sets of quality of care indictors (for example, Morgan, Zamora, & Hindmarsh, 2007). Only with expansion like these, the second approach may be useful for examining equity in access as it pertains to workforce planning.

(3) Measuring access by examining utilization relative to need

When enough data to establish an evidence-based standard do not exist, which is normally the case for developing broad-based models to examine access to health care, one can take the third approach to measure inequitable access. In this third approach, statistical models of healthcare utilization are used to

see if non-need factors (e.g., living in a rural area or income) are predictive of utilization or to develop a standard to which observed utilization can be compared. Two contrasts between the second and third approach are noteworthy. First, the second approach, measuring access against clinical care standards or guidelines, uses an *absolute* standard, while the third approach, in the absence of clinical care standards or guidelines, employs a *relative* standard. A relative standard is not necessarily evidence-based. It defines the standard by setting a norm based on typical health care use for persons at different levels of need. Second, with the third approach, researchers have primarily investigated equity in access to or utilization of health care as opposed to equity in *quality* of health care as with the second approach. This is not the result of a methodological deficiency of the third approach; the method itself allows researchers to investigate quality, but such investigations have not been pursued.

Generally, the starting point for this approach is a model that describes variation in healthcare utilization in the population (see Figure 1 for a graphic explanation). Ideally, one uses individual-level data (e.g., a national or provincial survey) representative of the population of interest to estimate a model of the form:

$$y_i = \alpha_0 + \sum_{j=1}^{J} \beta_j X_{ij} + \sum_{k=1}^{K} \lambda_k Z_{ik} + \varepsilon_i \qquad (1)$$

where y_i is the utilization for individual i, X_{ij} is a vector of need indicators, and Z_{ik} is a vector of non-need indicators. The coefficient vectors $\alpha, \beta,$ and λ estimated from this model describe the average utilization in the population by need and non-need indicators. It is possible to extend equation (1) to include interaction terms between need indicators (e.g., a certain chronic condition and age), though we ignore interaction terms here for simplicity.

Need indicators, X_{ij} often include age, sex, and health status (measured by, for example, self-perceived health, health-related quality of life, the number of chronic conditions, and/or the presence of major chronic conditions). Non-need indicators, Z_{ik}, include (a) those factors that should not relate to utilization if utilization is determined by need (e.g., immigration status should not be associated with utilization after adjustment for indicators of need), and/or (b) mediating factors between these factors and utilization, for example, availability of health care measured by a question as to whether the individual has a regular doctor or has experienced unmet need. Variables (b) explain a possible pathway between variables (a) and utilization. For example, a reason why people with low income use health care less than people with high income after adjustment for need indicators may be partly explained by not having a regular doctor.

In practice, few studies are able to fully estimate equation (1). Often, modeling efforts are limited by lack of data on variables to be included in X_{ij} or Z_{ik}, especially at the individual level of analysis. Indeed, models similar to equation (1) have often been estimated with small area data, such as in the U.K. (Sutton, Gravelle, Morris, Leyland, Windmeijer, Dibben et al., 2002). Whether one variable is a need or non-need indicator depends on the nature of that variable and what other need indicators are in the model. For example, education can be justified as a need indicator because the level of education is highly correlated with health status. However, if health status is directly measured, and measured well, then education can be used as a non-need indicator because the health status-adjusted effect of education may indicate the ability to navigate within health systems. Thus, in a model that has few need indicators (e.g., age and sex only) the primary role of education in the model would be a need indicator,

while in a model that has extensive need indicators (such as the ones listed above) education is primarily a non-need indicator.

Models in the form of equation (1) provide the foundation for two different methods for examining inequity in utilization relative to need: (i) examining the effect size of inequity, and (ii) quantifying the degree of inequity in the population.

(i) Examining the effect size of inequity

The majority of studies in the literature on access to health care use variants of equation (1) and examine whether a vector of non-need determinants of utilization Z_{il} is significantly associated with utilization y_i after controlling for need indicators X_{ik}. In other words, the primary interest of these studies is *the effect size of inequity*, more precisely, coefficients of the vector of non-need determinants of utilization Z_{il}. Non-need indicators Z_{ik} on which these investigations primarily focus are some of those factors that should not influence utilization after adjustment for need indicators (categorized as [a] above) rather than mediating factors that may explain why these factors might be associated with utilization (categorized as [b] above).

The relationship between utilization y_i and non-need determinants of utilization Z_{il} after controlling for need indicators X_{ik} will be either of the following: (a) Z_{il} is not associated with y_i, (b) Z_{il} is positively associated with y_i (e.g., higher socioeconomic status is associated with more use), or (c) Z_{il} is negatively associated with y_i (e.g., higher socioeconomic status is associated with less use). Association (a) suggests that utilization is based on need alone, thus, researchers consider it as implying equitable use. Both associations (b) and (c) indicate that non-need factors are at play, but judgment on equity differs in these cases. Researchers think of association (b) as signifying inequitable use for its *pro-advantaged* association. On the other hand, researchers tend to forgo judgment as to whether utilization is equitable or not for *pro-disadvantaged* association (c).

The key challenge of this approach is that its validity depends on adequate adjustment for need. Suppose, for example, that our equity stratifier is income, our need indicators X_{ik} include age and sex but not health status, and we find that people with lower income use health care more than people with higher income after controlling for age and sex. It would be premature to make judgment in this case, from this observation alone, as to whether health care utilization is equitable or not, because it is likely that our equity stratifier, income, is capturing unmeasured need for health care in this model. As this example shows, appropriate need adjustment is critical in this method. When appropriate need adjustment is not possible (due to, for example, lack of data or difficulty in data linkage), some previous studies included only Z_{ik} indicators and made interpretations based on assumptions about the X_{ik}. For example, N. P. Roos and Mustard (1997) and L. L. Roos et al. (2005) examined differences in health care use by neighbourhood income in Winnipeg with no adjustment for need factors and interpreted higher use among poorer neighbourhoods as a sign of equity based on parallel analyses showing sicker health profiles among poorer neighbourhoods.

Survey data are best suited to provide information on need indicators X_{ik} and non-need indicators Z_{il}. Accordingly, many of the recent studies employing this measurement approach (3i) use survey data, for example, the General Social Survey (Stephen Birch, Eyles, & Newbold, 1993; Curtis & MacMinn, 2008; Newbold, 1997), the National Population Health Survey (Curtis, 2006; Curtis & MacMinn, 2008; Dunlop, Coyte, & McIsaac, 2000; Fell, Kephart, Curtis, Bower, Muhajarine, Reid et al., 2007; Finkelstein, 2001;

Iron, Manuel, & Williams, 2003; McDonald & Kennedy, 2004; Sarma & Simpson, 2006), the Canadian Community Health Survey (Allin, 2006; Asada & Kephart, 2007; Curtis & MacMinn, 2008; McDonald & Kennedy, 2004; Quan et al., 2006; vanDoorslaer, Masseria, & Koolman, 2006), the Joint Canada/US Survey of Health (Lasser et al., 2006), and Aboriginal Peoples Survey (Newbold, 1997) for analysis of equity in Canada, and the Ontario Health Survey (S. J. Katz, Hofer, & Manning, 1996), the Quebec Health Survey (Blais & Maïga, 1999), and the Nova Scotia Nutrition Survey (G Kephart, Thomas, & MacLean, 1998; Veugelers, Yip, & Elliott, 2003; Yip, Kephart, & Veugelers, 2002) for provincial analysis.

Using survey data, however, one faces two major challenges in estimating equation (1). First, health care utilization is self-reported, which is prone to recall bias (Bellon, Lardelli, Luna, & Delgado, 2000; Reijneveld & Stronks, 1999; Ritter, Stewart, Kaymaz, Sobel, Block, & Lorig, 2001). To overcome these challenges, some researchers have linked survey data with other data, such as administrative data and physician claim data (Blais & Maïga, 1999; Fell et al., 2007; Finkelstein, 2001; Iron et al., 2003; G Kephart et al., 1998; Veugelers et al., 2003; Yip et al., 2002), census data (Rosenberg & Hanlon, 1996; Yip et al., 2002), and data from the Canadian Medical Association (Rosenberg & Hanlon, 1996). However, data linkage presents major logistical challenges in data access and compatibility between administrative data sources for studies that examine more than one province (Kephart, 2002). A second challenge is that survey data does not include information on many non-need indicators, such as the supply of providers.

While studies using the measurement approach (3i) share a common strategy, they vary greatly in the details of how it is employed, as summarized in Table 1. Researchers typically analyze general practitioner and specialist services separately, but some of them look at overall physician services. Furthermore, researchers model the use of these services, as expressed in equation (1), differently. Health care utilization data are often heavily skewed with the high prevalence of zero (i.e., non-users) and, using survey data, they are also counts (e.g., the number of visits or stays). To overcome these data characteristics, researchers employ different strategies, from log-transformed ordinary least squares for overall use to logistic regression for use versus non-use or low versus heavy use and two-part ("double hurdle") models with logistic regression for use versus non-use and zero-truncated negative binomial regression for the frequency of use among the users. Recent studies increasingly use two-part models for their conceptual and methodological appeal (Gerdtham, 1997; Pohlmeier & Ulrich, 1995). Two-part models explicitly acknowledge different decision-making and need processes at different stages of health care utilization. In addition, they account for the high prevalence of zero.

Table 3 summarizes studies using the measurement approach (3i) in terms of types of services (overall physician, general practitioner, and specialist services), modeling strategies (overall use, use versus non-use, and frequency of use among the users), and equity stratifiers (income, education, immigration status, visible minority status, geography, and Aboriginal status). Table 3 only lists studies that include health status as need indicator (see Table 5 in Appendix for a complete summary that includes both studies with and without need adjustment). We classify studies into three categories: the association between health care use and the equity stratifier is pro-advantaged (i.e., the high income earners, the highly educated, the employed, native born Canadians, Whites, the advantaged community residents, and non-Aboriginals use more health care), has no association, or is pro-disadvantaged. As discussed above, pro-advantaged use is considered as inequitable.

The studies in Table 3 vary considerably in how they adjust for need. Variables included as need adjusters range from age, sex and self-reported health status (Finkelstein, 2001; Katz et al., 1996) to much more comprehensive lists of need adjusters along with interactions between them (Asada & Kephart, 2007). Moreover, the same variable may be coded differently in different studies (e.g., different age groups, differing level of self-reported health status). It is thus likely that studies vary in the degree to which they fully adjust for differences in need.

Table 3 clearly suggests that the vast majority of studies using the measurement approach (3i) focus on income or education as the equity stratifier, and a very limited number of studies examine other equity stratifiers. Results from those studies examining equity by income or education are not absolutely conclusive, likely reflecting a wide variety of methods these studies employ. The literature on the whole, however, suggests that specialist services, use or non-use in particular, are of concern for inequity in Canada. In addition, it appears that general practitioner services are mostly equitable in Canada, but the pro-rich association with use or non-use that most recent studies found (Allin, 2006; Asada & Kephart, 2007; vanDoorslaer et al., 2006) hints this conclusion might be premature. Given these differences in the pattern of utilization by income and education between general practitioner and specialist services, it is not surprising that studies looking at overall physician use ("doctor" in Table 3) do not provide a clear message regarding equity.

We found only a very limited number of studies since 1990 that examined inequity in health care use in Canada by immigration status, visible minority status, Aboriginal status, or geography. Studies currently available suggest that inequity by immigration status (McDonald & Kennedy, 2004; Wen, Goel, & Williams, 1996), visible minority status (Blais & Maïga, 1999; Quan et al., 2006; Wen et al., 1996), Aboriginal status (Wen et al., 1996), or geography (Law et al., 2005; Veugelers, Yip, & Burge, 2004) is not of concern both for general practitioner and specialist use in Canada. More studies are needed to gain a clear understanding of the importance of different equity stratifiers in access to health care. In addition, a small sample size is always a challenge for studies examining immigration status, visible minority status, and Aboriginal status, and caution is in order to interpret their results.

Given generally perceived vulnerability of immigrants, visible minorities, and Aboriginals to access to adequate social services, little focus on these equity stratifiers in the literature is surprising. It is beyond the scope of this paper to examine why this is so, but it is noteworthy that there appears to be a clear separation of research communities, those who study socioeconomic status, and those who study immigration status, visible minority status, and Aboriginal status. Geography has an important implication in access to and delivery of health care in Canada given its vast land. We hope to see more studies in future. We believe the time is ripe for analysis using geography as the equity stratifier because various multi-level modeling techniques and statistical software are now readily available reflecting an explosion of interests in the role of geography in the distribution of determinants of health and health outcomes. In the area of equity in access to health care, only a handful of studies have appeared as pioneers (Veugelers et al., 2004).

(ii) Quantifying the degree of inequity in the population

The second method to measure utilization relative to need quantifies the degree of inequity in utilization in the population. An example would be helpful to contrast the different focus between the first method (the effect size of inequity) and the second method (the degree of inequity in the population). Suppose the equity stratifier we are interested in is income. If we asked how different health care use is between

the rich and the poor with the same health status, the first method would provide an answer to this question. We might learn, for example, that despite the same health status, the poor use health care only half as much as the rich. This information on the *effect size* of inequity by income is no doubt important, yet in making policy to address this inequity a further question arises: How many people are affected by this inequity? The *population impact* of this inequity would be greater in the population with a large proportion of the poor than the population with a small proportion of the poor. The second method that we introduce below quantifies the degree of inequity in the population to show the population impact of inequity.

The second method first estimates the *need-expected* utilization. The need-expected utilization is the standard utilization levels for a sample representative of the population based on need alone. Need-expected utilization is computed from equation (1) by holding values of Z_{il} constant (usually at their means) so that need factors alone influence the predictions. That is, the effects of non-need factors are purged using an equation of the form:

$$\hat{y}_i^* = \hat{\alpha}_0 + \sum_{j=1}^{J} \hat{\beta}_j X_{ij} + \sum_{k=1}^{K} \hat{\lambda}_k \bar{Z}k_{ik} \tag{2}$$

where the $\hat{y}_i^*$ is the need-expected utilization for sample member *i* when non-need variables are held at a constant value, and the $\hat{\alpha}$, $\hat{\beta}$, and $\hat{\lambda}$ are from equation (1).

Next, for each sample member *i* we compare the need-expected utilization and the observed utilization and summarize the comparison into a score. This score can be calculated in various ways. For example, most simply, we can calculate the difference between the observed and need-expected utilization for each sample member as:

$$\hat{r}_i = y_i - \hat{y}_i^* \tag{3}$$

This score suggests the regression residuals predicted by holding the Z_{il} constant. Alternatively, following van Doorslaer and his colleagues (2006), we can adjust $\hat{r}_i$ for the observed average level of utilization in the population, y^m:

$$\hat{r}_i^* = y_i - \hat{y}_i^* + y^m \tag{4}$$

The addition of y^m puts $\hat{r}_i$ in the context of the observed average level of utilization in the population. That is, the same $\hat{r}_i$ is smaller in the population with a higher y^m than one with a lower y^m. Essentially, $\hat{r}_i^*$ is a measure of the difference between the observed and need-expected utilization $\hat{r}_i$ standardized for different levels of observed utilization across populations.

After each sample member is assigned a score comparing the need-expected and observed utilization, we summarize the distribution of this score within the population (e.g., the nation or the region) to quantify the degree of inequity. A summary measure can be the mean, the total volume (i.e., the sum of $\hat{r}_i$ in the population), or an inequality index, which has long been used to measure income inequality or health inequality, such as the Gini coefficient or the Concentration Index (Harper & Lynch, 2005).

Unlike the first method, which always identifies inequity by equity stratifier, the second method can identify either inequity by an equity stratifier or as the overall degree of inequity regardless of equity stratifiers, depending on which summary measure is employed. For example, the Concentration Index measures the distribution of the score by an equity stratifier (e.g., income). The mean, total volume, and

the Gini coefficient, on the other hand, measure the distribution of the score across individuals with no equity stratifier, providing an overall degree of inequity. The Gini coefficient moves between zero (the use of health care is according to need) and one (the use of health care is most inequitable). The Concentration Index ranges from -1 to 1, and just as with the Gini coefficient, health care use is equitable when the Concentration Index equals zero. When the Concentration Index is positive the association is pro-advantaged, and when the Concentration Index is negative the association is pro-disadvantaged.

To our knowledge, to date only two published studies are available that used the second method in Canada (vanDoorslaer et al., 2006 [a more thorough version of this paper was published as an OECD discussion paper, van Doorslaer & Masseria, 2004] and Allin, 2008 [also as Allin, 2006]). Both studies investigated inequity in general practitioner and specialist services separately and combined, obtained data from the Canadian Community Health Survey, and used the Concentration Index with income as the equity stratifier. van Doorslaer and his colleagues examined inequity in overall use, use versus non-use, and frequency of use among the users in Canada, while Allin investigated inequity in the same manner in each province.

According to van Doorslaer and his colleagues, in Canada use of physician services is equitable, the use of general practitioner services is pro-poor, and the use of specialist services is pro-rich. Their further analysis and Allin's analysis add detailed information as to where inequity arises. They showed that the use vs. non-use of general practitioners and specialists is pro-rich in Canada and in all provinces, except Prince Edward Island for general practitioner services. Among those who used general practitioner services at least once, in Canada and all provinces, people with lower income visit general practitioners more frequently. On the other hand, users of specialist services in Canada as a whole but only in Alberta and Prince Edward Island visit specialists less frequently than people with higher income.

These results were obtained by estimating equation (1), and their methods are nothing different from the first method described above (that is why their results are included in Table 3). What is unique about their analyses is that they proceeded to express the degree of inequity by the Concentration Index. By so doing, these studies quantify the degree of inequity in the population. For example, the degree of pro-rich inequity for specialist services in Canada (the Concentration Index = 0.054) is around the middle of the range of degrees of pro-rich inequity for specialist services experienced in OECD countries (ranging from no association in the Netherlands, Norway, and the United Kingdom to the biggest Concentration Index, 0.136 in Finland) (vanDoorslaer et al., 2006), and within Canada pro-rich inequity for specialist services is particularly pronounced in Nova Scotia, Manitoba, and Newfoundland (Allin, 2006).

While van Doorslaer and his colleagues and Allin investigate the degree of inequity *by income* in the population using the Concentration Index, it is possible to investigate the degree of *overall* inequity in the population using other summary measures. In our work on resource allocation, we estimated overall inequity in the use of general practitioner and specialist services in each province in Canada (Asada & Kephart, 2006a, b). As van Doorslaer and his colleagues and Allin, we also used the Canadian Community Health Survey, and our modeling approach parallels theirs. The difference is the choice of the summary measure – they used the Concentration Index, while we chose the mean. More precisely, after estimating the need-expected use of these services for each individual in our data (equation [2]), we assigned each individual a score of the difference between the observed and the need-expected use (equation [3]) and calculated the population-weighted average difference between the observed and need-expected utilization in each province.

As Table 4 shows, we observed that overall inequity in general practitioner use is experienced in, in the order of greater inequity, Quebec (the mean difference = -0.74), New Brunswick (-0.25), Prince Edward Island (-0.13), and Manitoba (-0.04), while overall inequity in specialist use is indicated in Alberta (-0.08), Saskatchewan (-0.07), Nova Scotia (-0.04), and New Brunswick (-0.03).

Discussion

What have we learned in Canada from the equity literature?

This review of recent literature on access to health care in Canada offers the following three key observations. First, methodological approaches employed by studies investigating equity in access or use of health care vary, and they can be summarized into three groups: (1) measuring access problems directly, (2) measuring access against clinical care standards or guidelines, and (3) measuring access by examining utilization relative to need. The method (3) can be further categories into two subcategories: (i) examining the effect size of inequity, and (ii) quantifying the degree of inequity in the population. The most common measurement approach used in the current literature is approach (3). In approach (3) the vast majority of studies use the method (3i), but our critical review suggests that the method (3ii) is an emerging method with great promise for future studies. All of these three approaches try to measure access problems, yet their constructs are not exactly overlapping. The field will benefit from further work clarifying exactly what access problems each of these approaches attempt to measure.

Second, whatever measurement approaches one uses, we should be concerned about inequity in access to physician services in Canada. Under the Canada Health Act inequity in physician services is supposed to be of no concern, but our review suggests otherwise. To further explore inequity in physician services, future research needs to examine inequity in the *continuum of care*. Most of the studies we reviewed focus on equity in access to one type of health care service at a time, for example, access to specialist services. But where exactly should we target to address access problems of specialist services? Would referral from general practitioners be the core problem? Would there be a particular type of specialist service that hinders the access? And how would the access problems in specialist services relate to patient outcomes? Recent studies focusing on a series of specialized services for acute myocardial infarction (Alter, 2003; Alter et al., 2004; Pilote, Joseph, Bélisle, & Penrod, 2003), for example, take a system approach for investigating inequity and offer a future direction. Given that even health services governed by the Canada Health Act present equity problems, furthermore, it is likely that there will be greater need for research in equity in access to services excluded from the Canada Health Act, such as pharmaceuticals, dental services, physiotherapy, and occupational therapy. Recent studies suggest that private insurance coverage for these services is associated with the use of physician services (Allin & Hurley, 2008; Stabile, 2001). Future research on access to health care needs to incorporate a dynamic system perspective.

Third, equity stratifiers most frequently investigated are income and education. The focus on socioeconomic status is probably no accident because the Canada Health Act explicitly states in its preamble to avoid financial and other barriers to health care. While researchers should continue to investigate roles of socioeconomic status in access to health care with the development in methods and the improvement in data availability and quality, much more studies need to investigate other equity stratifiers such as immigration status, visible minority status, Aboriginal status, and geography.

Despite the proliferation of studies examining equitable access and the indications of the existence of inequitable access in Canada, curiously, these studies rarely directly connect to policies designed to overcome limited access. We suspect part of the reason for the lack of direct connection to policy may be that these studies are often conducted and perceived as an "equity test" for the Canada Health Act. Researchers have focused on describing whether access to health care is indeed equitable as the Canada Health Act has promised. To move on policy development and strategies for improved access, considerations both for health care users and providers are necessary. In particular, we need analyses that inform us how workforce supply, deployment, and organization affect inequity. We believe collaboration with the field of medical workforce planning is a key step forward for policy development for equitable access to health care at the provider side.

Implications of the equity literature for workforce planning

As noted at the outset of this paper, it has been common practice in workforce planning to use current health care utilization as the basis for measuring service requirements, and the current number of providers as the basis for determining the number needed to meet those requirements (Birch et al., 2007; O'Brien-Pallas et al., 2001; Verhulst et al., 2007). The literature on inequity serves as a clear reminder that current patterns of health care utilization and resource use are only partially determined by need. Reliance on observed utilization for planning may allocate resources inequitably relative to need, and perpetuate current inequities in access to healthcare. The equity literature provides evidence on the degree to which current patterns of utilization deviate from needed services and provides the basis for studying the reasons for inequitable access, most of which will be of direct relevance to workforce planning and healthcare delivery. It serves to remind medical workforce planners that a fundamental goal of medical workforce planning should be to promote equitable access to health care.

The equity literature suggests that if workforce planning is going to promote equity in the healthcare system, three steps are necessary: (1) workforce planning should be based on need, (2) workforce planning should routinely incorporate measures of inequity, and (3) workforce planning should play a major role in gathering and using evidence on why inequity exists.

(1) Workforce planning should be based on need

Workforce planners and researchers now widely advocate that workforce planning should be based on need and have adopted need into planning frameworks (Advisory Committee on Health Delivery and Human Resources, 2005; Birch et al., 2007). The equity literature provides a strong rational for this argument as well as set of methods that can inform need-based approaches to workforce planning. In particular, the equity literature suggests that workforce planning and forecasting models should be based on *need-expected* utilization and resource requirements, not on observed utilization. It also offers some guidance on how this can be achieved.

Ideally, expected utilization would be based upon clear evidence on appropriate, effective, and efficient care. Approach 2 provides guidance toward this direction. However, as we noted in our review, this approach will be only directly relevant with the kind of expansion that we see in the development of quality indicators to evaluate care delivery models in primary care and management of chronic conditions (for example, Bodenheimer, Wanger, & Grubach, 2002a, b; Rundall, Shortell, Wang, Casalino, Bodenheimer, Gillies et al., 2002). For more general workforce planning models, estimating expected utilization based on evidence on quality care is rarely feasible. In such cases one can employ approach

3, which estimates standard, expected levels of utilization given need from statistical models that describe utilization in the population as a function of need and non-need factors. The equity literature emphasizes the importance of incorporating both need and non-need factors into these models so that the effects of non-need factors can be purged. These statistical models used in the equity literature are directly relevant for need-based workforce planning models.

The methods we have reviewed show, in part, how the need-based analytical framework for workforce planning proposed by Birch and his colleagues (Birch et al., 2007) can be implemented. Departing from the traditional planning of requirements for absolute numbers of medical workforce, Birch and his colleagues propose to include four components in estimating health human resource requirements: demography, epidemiology, level of service, and productivity. In essence, their framework emphasizes the importance of acknowledging need for health care of the population to be served as well as the way in which providers deliver services. The equity literature informs methods for determining the "level of service" (i.e., expected utilization) required given the demography and epidemiology (i.e., level of need) in a population.

(2) Workforce planning should routinely incorporate measures of inequity

To address inequity, workforce planning must be informed about where observed utilization differs from need-expected utilization. Based on the equity literature, workforce planners and researchers can collect data and indicators that identify these gaps. Moreover, they can use measures of inequity (i.e., measures of the degree of deviation between observed and need-expected utilization) as quality indicators for workforce planning to guide further efforts to meet the ultimate objective of workforce planning, promoting access to timely and quality health care.

Of the approaches we reviewed in the equity literature, approach 3, method (3ii) in particular, is best suited for this purpose. This method shows how deviations between observed and need-expected utilization can be estimated and summarized into the degree of inequity at the population level. Comparisons of the degrees of inequity across regions or subpopulations can provide a basis for reallocation of resources to bring them in line with relative need. Measures of the degree of inequity in the population may also serve as an indicator of progress and quality in workforce planning. For example, the Concentration Index, which describes inequity by a given equity stratifier, could be used to measure progress in addressing a particular type of inequity (e.g. inequity by income), while an overall measure of inequity such as the Gini index could be used as a summary indicator of progress in equitable utilization overall.

(3) Workforce planning should play a major role in gathering and using evidence on why inequity exists

Research on access to health care can help medical workforce planners to investigate what aspect of medical workforce may promote equitable access to health care. The most popular approach to investigate access to health care, measuring access by examining utilization relative to need (approach 3), will be useful for such investigation. Specifically, equation (1) can incorporate various workforce factors in the model (as a non-need indicator, Z_{il}) to identify if and what workforce factors are strongly associated with health care use and what role they can play in reducing inequity. These factors might include measures of the supply of health providers, the mix of health care providers, their workload, or the organization of care (i.e., delivery models). Evidence on factors associated with lower or higher utilization after adjustment for need, in conjunction with evidence on how these factors are distributed in

the population, can assist prioritization of workforce planning efforts. Of particular value to workforce planning, these models can be used to study the role of workforce planning factors in mediating or addressing inequities. For example, with such models one could assess whether the effects of income or immigrant status on utilization (i.e., inequity effects) are reduced by workforce planning factors (e.g., alternative care delivery models). This type of analysis would, in turn, be of great value to the equity literature as it helps move the focus from describing inequity to reducing inequity.

In conclusion, we believe exciting opportunities exist for further development of research on and policy in equity in health care and medical workforce planning. It is our hope that this paper sheds light on these potentials.

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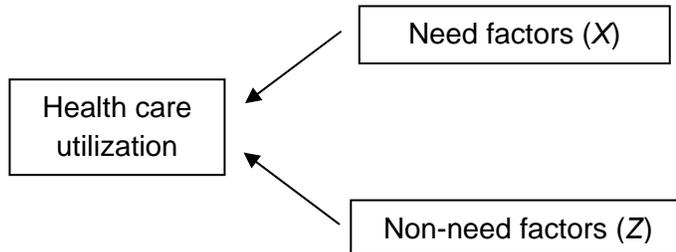
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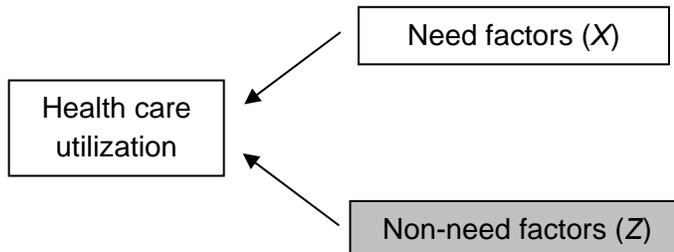
Figure 1. Graphic explanation of Approach 3

Starting point for the third approach, measuring access by examining utilization relative to need

Estimating a model to explain current utilization – using individual-level data, explain what need factors and non-need factors are associated with health care use of an individual

```
                              ┌─────────────────────┐
                              │  Need factors (X)   │
                              └─────────────────────┘
         ┌──────────────┐    ↙
         │ Health care  │
         │ utilization  │
         └──────────────┘    ↖
                              ┌─────────────────────┐
                              │ Non-need factors (Z)│
                              └─────────────────────┘
```

(3i) Examining the effect size of inequity

Examining whether utilization is associated with the non-need factor of interest (e.g., income) after adjusting for need factors as well as other non-need factors (e.g., education, immigration status, etc.)

```
                              ┌─────────────────────┐
                              │  Need factors (X)   │
                              └─────────────────────┘
         ┌──────────────┐    ↙
         │ Health care  │
         │ utilization  │
         └──────────────┘    ↖
                              ┌─────────────────────┐
                              │ Non-need factors (Z)│
                              └─────────────────────┘
```

(3ii) Quantifying the degree of inequity in the population

Step 1: Estimating the need-expected utilization – purging the influence of non-need factors, predict how much health care an individual would use given his/her need for health care

```
                              ┌─────────────────────┐
                              │  Need factors (X)   │
                              └─────────────────────┘
       ┌─────────────────┐   ↙
       │  Need-expected  │
       │   utilization   │
       └─────────────────┘   ↖
                              ┌─────────────────────┐         Holding non-need
                              │ Non-need factors (Z)│         factors constant
                              └─────────────────────┘
```
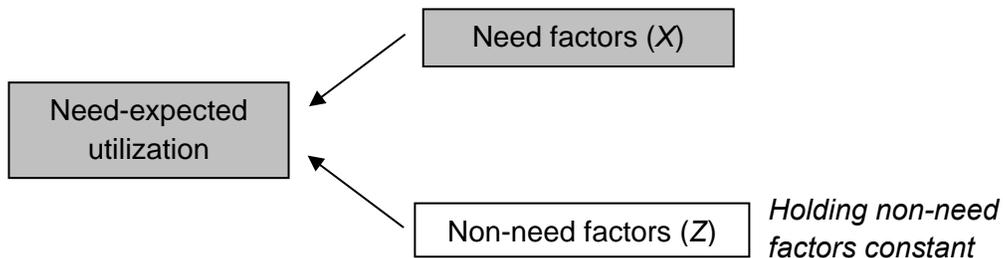
Step 2: Comparing the need-expected utilization and observed utilization and summarizing the comparison into a score for each individual

```
┌─────────────────┐        ┌─────────────────┐
│ Need-expected   │ ◄────► │ Observed        │
│ utilization     │        │ utilization     │
└─────────────────┘        └─────────────────┘
                     │
                     ▼
            ┌─────────────────┐
            │ Score for each  │
            │ individual      │
            └─────────────────┘
```
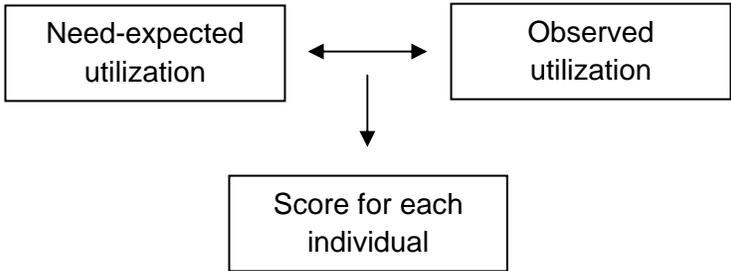
e.g., Score = (observed number of visit) − (need-expected number of visit)

By assigning a score to each individual, we can know how scores are distributed within the population

Population A   Population B   Population C
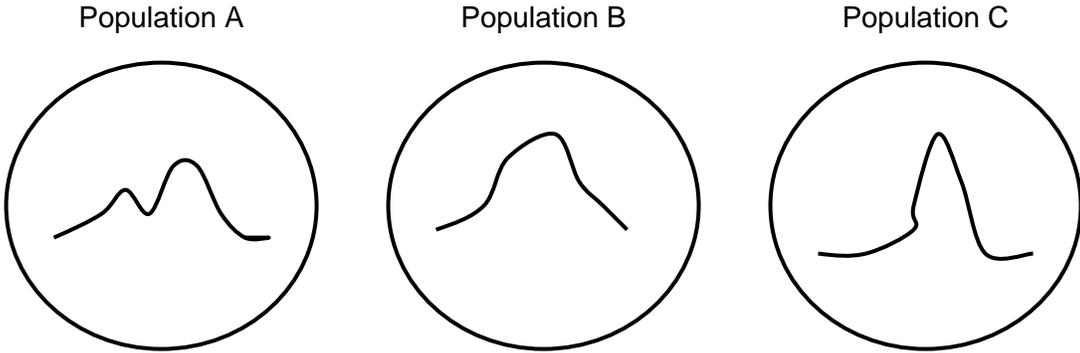
Step 3: Quantifying the degree of inequity in each population by the mean, total volume, or index to summarize the distribution (e.g., the Gini coefficient or the Concentration Index) of the scores from Step 2

Population A   Population B   Population C

Degree of inequity   Degree of inequity   Degree of inequity

Table 1. Differences in applications of three measurement approaches

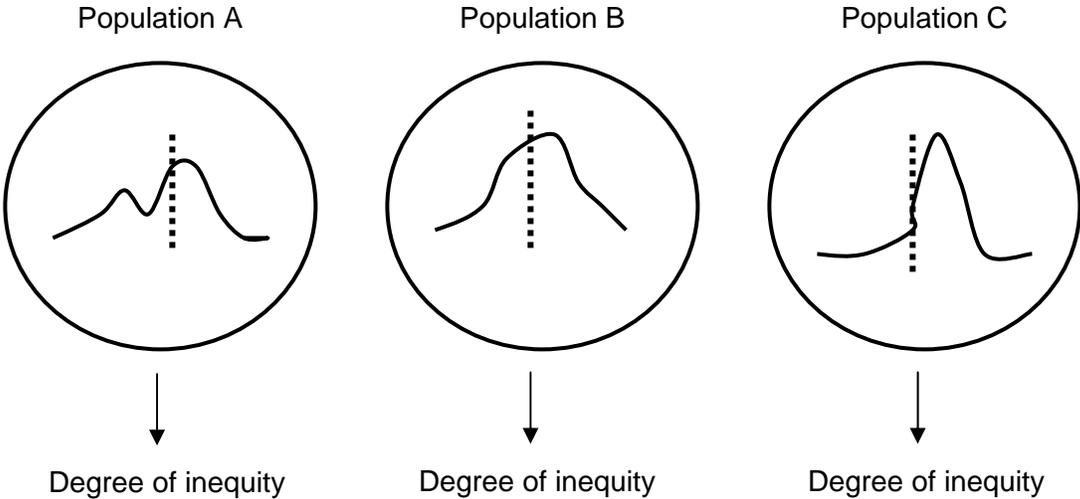| Measurement approach			
(1) Measuring access problems directly	**(2) Measuring access against clinical care standards or guidelines**	**(3) Measuring access by examining utilization relative to need**	
		(i) Examining effect size of inequity	**(ii) Quantifying the degree of inequity**
Types of health services			
Health services overall	Pap test	Physician overall	Physician overall
Specific procedures	Mammogram	GP	GP
GP	Clinical breast exam	SP	SP
Immediate care	PSA		
	Influenza vaccination		
Equity stratifiers (charactieristic examined in relation to inequity)			
Income	Income	Income	None (overall)
Ethnic/visible minority	Education	Education	Income
Aboriginal status	Ethnic/visible minority	Immigration status	
		Ethnic/visible minority	
		Aboriginal status	
Data source			
Survey	Survey	Survey	Survey
Administrative data		Administrative data	
		Census	
Level of analysis			
Ecological	Individual	Ecological	Ecological
Individual		Individual	Individual
		Multi-level	
Statistical modeling			
Logistic regression	Logistic regression	Overall use	Overall use
		Logistic (use/nonuse, low/heavy use)	Two-part model
		Two-part model	
		Need indicators	
		Age	Age
		Sex	Sex
		Socioeconomic status	Socioeconomic status
		Health behaviour	Health behaviour
		Health status	Health status

Table 2. Differences in key characteristics of three measurement approaches

Measurement approach			
(1) Measuring access problems directly	**(2) Measuring access against clinical care standards or guidelines**	**(3) Measuring access by examining utilization relative to need**	
Primary focus of examination			
Access Utilization Quality	Quality	Utilization	
Examination of equity			
By any equity stratifier	By any equity stratifier	By any equity stratifier	
Type of standard			
Subjective	Absolute	Relative	
Strength			
Offers intuitive interpretation	Evidence-based	Can be applied to any types of health services and offer an overall picture of equity in helth care	
Weaknesses			
Subjective assessment, which may lead to: - Underestimation of access problems by excluding those who do not identify their need - Overestimation of access problems by capturing complaints from the hypochondriac	Evidence, consensus, data, or measurement tools lacking for most types of utilization Often procedure or condition specific and does not offer an overall picture of equity in health care	Not necessarily evidence-based, and typical health care generally offered in the current system taken as a norm	
		(i) Examining effect size of inequity	**(ii) Quantifying the degree of inequity**
		Focus	
		Effect size of inequity	Population impact of inequity
		Indentification of inequity	
		By equity stratifier	By equity stratifier Overall

Table 3. Summary of selected studies using Approach 3, Method (i)

	Doctor			GP			SP		
	Overall	Use/nonuse	Frequency	Overall	Use/nonuse	Frequency	Overall	Use/nonuse	Frequency
Pro-advantaged									
Income		Curtis & McMinn (2008), van Dooslaer et al (2006), Allin (2006) -- except PEI and NS	Curtis & McMinn (2008)	Allin (2008) -- except QC	Asada & Kephart (2007), van Dooslaer et al (2006), Allin (2008) -- except PEI		van Doorslaer et al (2006), Allin (2008)	McIsaac et al (1997), Dunlop et al (2000), Alter et al (1999), Pilote et al (2003), Asada & Kephart (2007), Curtis & McMinn (2008), van Dooslaer et al (2006), Allin (2008)	Curtis & McMinn (2008), van Doorslaer et al (2006), Allin (2008) -- AB and PEI
Education		Curtis & McMinn (2008), Curtis (2006)			Dunlop et al (2000)			McIsaac et al (1997), Asada & Kephart (2007), Sarma & Simpson (2006), Finkelstein (2001), Dunlop et al (2000) -- female, Curtis & McMinn (2008)	Sarma & Simpson (2006), Dunlop et al (2000) -- female, Curtis & McMinn (2008)
Immigration status		Curtis & McMinn (2008)*	Curtis & McMinn (2008)*		McDonald & Kennedy (2004)*			Curtis & McMinn (2008), Wen et al (1996) -- Asian*	Curtis & McMinn (2008)
Visible minority status									
Aboriginal status									
Geography									
No association									
Income	Finkelstein (2001), van Doorslaer et al (2006)	Curtis (2006), Sarma & Simpson (2006)	Sarma & Simpson (2006), Curtis & McMinn (2008)	Allin (2008) -- QC	McIsaac et al (1997), Iron et al (2003), Eyles et al (1995), Newbold (1997), Law et al (2005), Sarma & Simpson (2006), Dunlop et al (2000)	Eyles et al (1995), Sarma & Simpson (2006), Dunlop et al (2000)	Finkelstein (2001), Sarma & Simpson (2006)		McIsaac et al (1997), Sarma & Simpson (2006), Finkelstein (2001), Asada & Kephart (2007)
Education		Sarma & Simpson (2006)	Sarma & Simpson (2006), Curtis & McMinn (2008) -- high school graduate vs. university education	Fell et al (2007)	McIsaac et al (1997), Iron et al (2003), Eyles et al (1995), Newbold (1997), Law et al (2005), Birch et al (1993), Asada & Kephart (2007), Sarma & Simpson (2006)	Eyles et al (1995), Birch et al (1993), Sarma & Simpson (2006), Dunlop et al (2000)		Dunlop et al (2000) -- male	McIsaac et al (1997), Asada & Kephart (2007), Finkelstein (2001), Dunlop et al (2000) -- male
Immigration status		Curtis & McMinn (2008)**			McDonald & Kennedy (2004)**, Wen et al (1996) -- Asian and European*			Wen et al (1996)	
Visible minority status				Blais & Maiga (1999)	Wen et al (1996)		Blais & Maiga (1999)	Quan et al (2006), Wen et al (1996)	
Aboriginal status					Wen et al (1996)			Wen et al (1996)	
Geography				Veugelers et al (2004)	Law et al (2005)				
Pro-disadvantaged									
Income	Katz et al (1996), Roos et al (2005)		van Doorslaer et al (2006), Allin (2008)	Fell et al (2007), van Doorslaer et al (2006)		Asada & Kephart (2007), van Doorslaer et al (2006)			
Education			Curtis & McMinn (2008) -- lower education vs. high school graduate			Asada & Kephart (2007)			
Immigration status		Curtis (2006)			Wen et al (1996)**				
Visible minority status					Quan et al (2006)				
Aboriginal status									
Geography									

* New arrivals
** Long time residents

Table 4. Example of Approach 3, Method (3ii)

	Observed number of visits	Need-expected number of visits	Observed minus need-expected visits
General practitioner services			
Newfoundland & Labrador	4.00	3.32	0.67
Prince Edward Island	3.35	3.48	-0.13
Nova Scotia	3.95	3.87	0.09
New Brunswick	3.46	3.71	-0.25
Quebec	2.46	3.20	-0.74
Ontario	3.55	3.48	0.07
Manitoba	3.39	3.43	-0.04
Saskatchewan	3.90	3.66	0.24
Alberta	3.72	3.50	0.22
British Columbia	3.95	3.49	0.46
Specialist services			
Newfoundland & Labrador	0.71	0.67	0.04
Prince Edward Island	0.77	0.72	0.05
Nova Scotia	0.79	0.82	-0.04
New Brunswick	0.76	0.79	-0.03
Quebec	0.89	0.69	0.20
Ontario	0.90	0.75	0.15
Manitoba	0.78	0.71	0.07
Saskatchewan	0.70	0.77	-0.07
Alberta	0.68	0.76	-0.08
British Columbia	0.77	0.76	0.01

Table 5. Extended summary of selected studies using Approach 3, Method (i)

	Need adjustment	Doctor			GP			SP		
		Overall	Use/nonuse	Frequency	Overall	Use/nonuse	Frequency	Overall	Use/nonuse	Frequency
Pro-advantaged										
Income	No		Lasser et al (2006)			Rosenberg & Hanlon (1996)			Rosenberg & Hanlon (1996)	
	Yes	Curtis & McMinn (2008), van Dooslaer et al (2006), Allin (2006) -- except PEI and NS	Curtis & McMinn (2008)	Allin (2008) -- except QC	Asada & Kephart (2007), van Dooslaer et al (2006), Allin (2008) -- except PEI		van Doorslaer et al (2006), Allin (2008)	McIsaac et al (1997), Dunlop et al (2000), Alter et al (1999), Pilote et al (2003), Asada & Kephart (2007), Curtis & McMinn (2008), van Dooslaer et al (2006), Allin (2008)	Curtis & McMinn (2008), van Doorslaer et al (2006), Allin (2008) -- AB and PEI
Education	No									
	Yes	Sarma & Simpson (2006)	Sarma & Simpson (2006), Curtis & McMinn (2008) -- high school graduate vs. university education	Fell et al (2007)	McIsaac et al (1997), Iron et al (2003), Eyles et al (1995), Newbold (1997), Law et al (2005), Birch et al (1993), Asada & Kephart (2007), Sarma & Simpson (2006)	Eyles et al (1995), Birch et al (1993), Sarma & Simpson (2006), Dunlop et al (2000)		Dunlop et al (2000) -- male	McIsaac et al (1997), Asada & Kephart (2006), Finkelstein (2001), Dunlop et al (2000) -- male
Immigration status	No	McDonald & Kennedy (2004) -- newcomers								
	Yes	Curtis & McMinn (2008)*	Curtis & McMinn (2008)*		McDonald & Kennedy (2004)*			Curtis & McMinn (2008), Wen et al (1996) -- Asian*	Curtis & McMinn (2008)
Visible minority status	No									
	Yes									
Aboriginal status	No				Newbold (1997)			Martens et al (2005)		
	Yes									
Geography	No							Veugelers et al (2003)	Rosengerg & Hanlon (1996)	
	Yes									

* New arrivals
** Long time residents

Table 5. Extended summary of selected studies using Approach 3, Method (i) (continued)

	Need adjustment	Doctor			GP			SP		
		Overall	Use/nonuse	Frequency	Overall	Use/nonuse	Frequency	Overall	Use/nonuse	Frequency
No association										
Income	No						Veugelers et al (2003)	Roos & Mustard (1997)		
	Yes	Finkelstein (2001), van Doorslaer et al (2006)	Curtis (2006), Sarma & Simpson (2006)	Sarma & Simpson (2006), Curtis & McMinn (2008)	Allin (2008) -- QC	McIsaac et al (1997), Iron et al (2003), Eyles et al (1995), Newbold (1997), Law et al (2005), Sarma & Simpson (2006), Dunlop et al (2000)	Eyles et al (1995), Sarma & Simpson (2006), Dunlop et al (2000)		Finkelstein (2001), Sarma & Simpson (2006)	McIsaac et al (1997), Sarma & Simpson (2006), Finkelstein (2001), Asada & Kephart (2007)
Education	No									
	Yes		Sarma & Simpson (2006)	Sarma & Simpson (2006)	Fell et al (2007)	McIsaac et al (1997), Iron et al (2003), Eyles et al (1995), Newbold (1997), Law et al (2005), Birch et al (1993), Asada & Kephart (2007), Sarma & Simpson (2006)	Eyles et al (1995), Birch et al (1993), Sarma & Simpson (2006), Dunlop et al (2000)		Dunlop et al (2000) -- male	McIsaac et al (1997), Asada & Kephart (2007), Finkelstein (2001), Dunlop et al (2000) -- male
Immigration status	No		McDonald & Kennedy (2004)**, Lasser et al (2006), Curtis (2006)	Chen et al (1996)	Globerman (1998), Laroche (2000)			Globerman (1998), Laroche (2000)		
	Yes		Curtis & McMinn (2008)**			McDonald & Kennedy (2004)**, Wen et al (1996) -- Asian and European*			Wen et al (1996)	
Visible minority status	No		Lasser et al (2006)							
	Yes				Blais & Maiga (1999)	Wen et al (1996)		Blais & Maiga (1999)	Quan et al (2006), Wen et al (1996)	
Aboriginal status	No									
	Yes					Wen et al (1996)			Wen et al (1996)	
Geography	No				Veugelers et al (2003)	Rosenberg & Hanlon (1996)				
	Yes				Veugelers et al (2004)	Law et al (2005)				

* New arrivals
** Long time residents

Table 5. Extended summary of selected studies using Approach 3, Method (i) (continued)

	Need adjustment	Doctor			GP			SP		
		Overall	Use/nonuse	Frequency	Overall	Use/nonuse	Frequency	Overall	Use/nonuse	Frequency
Pro-disadvantaged										
Income	No	Kephart et al (1998), Roos et al (2005), Roos & Mustard (1997)		Yip et al (2002)	Roos & Mustard (1997)		McIsaac et al (1997)			
	Yes	Katz et al (1996), Roos et al (2005)		van Doorslaer et al (2006), , Allin (2008)	Fell et al (2007), van Doorslaer et al (2006)		Asada & Kephart (2007), van Dooslaer et al (2006)			
Education	No	Kephart et al (1998)		Yip et al (2002)			McIsaac et al (1997)			Veugelers et al (2003)
	Yes			Curtis & McMinn (2008) -- lower education vs. high school graduate			Asada & Kephart (2007)			
Employment	No									
	Yes									
Immigration status	No									
	Yes		Curtis (2006)			Wen et al (1996)**				
Visible minority status	No									
	Yes					Quan et al (2006)				
Aboriginal status	No	Martens et al (2005)								
	Yes									
Geography	No									
	Yes									

* New arrivals
** Long time residents

Appendix 1. Detailed explanation of the search process

A. Database search

We searched PubMed using the keyword combinations as follows:

- #1: Inequality
- #2: Unequal
- #3: Disparity
- #4: Utilization
- #5: Access
- #6: Canada
- #7: ((#1) or (#2) or (#3)) AND (#4)
- #8: ((#1) or (#2) or (#3)) AND (#5)
- #9: (((#1) or (#2) or (#3)) AND (#4)) AND (#6)
- #10: (((#1) or (#2) or (#3)) AND (#5)) AND (#6)

The search #9 and #10 returned 512 and 274 articles, respectively. From these, we selected the articles that would be relevant to our paper. To be relevant to our paper, articles must have used quantitative methods and focused on general access rather than small or targeted populations (for example, disease specific patient groups).

B. Hand-search

Step 1: Identifying the core journals

From our previous work on equity in access to health care (Asada, Y., & Kephart, G. [2007]. Equity in Health Services Use and Intensity of Use in Canada. *BMC Health Services Research,* 7[41]), we identified 21 core articles. These articles were published in the following 13 journals, and we considered these journals as core journals, in which relevant papers had likely been published.

- *CMAJ*
- *International Journal of Health Services*
- *Journal of Epidemiology and Community Health*
- *Health economics*
- *Healthcare Policy*
- *American Journal of Public Health*
- *American Heart Journal*
- *Health Services Research*
- *Milbank Quarterly*
- *Social Science of Medicine*
- *Chronic Diseases in Canada*
- *Health Policy*
- *Canadian Journal of Public Health*

Step 2: Searching individual journals

We searched for relevant articles by reviewing every single issue of these 13 journals from the period from 1990 to March 2008. During the search, we closely focused on a theme of "unequal access to health care services in Canada."

Step 3: Cross validation 1 – Search through the references

To complement the hand search in the above cited 13 journals, we examined the references of the initial 21 core articles.

Step 4: Cross validation 2 – Search through the Web of Science

To follow up, we also used the Web of Science, which allowed us to identify the publications that cite each of these 21 core publications.

Combining these two methods, we obtained 98 articles. From these, we selected 53 articles, which target physician service utilization.