Do Some Physician Groups See Sicker Patients Than Others?

Implications for Primary Care Policy in Manitoba

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We thank the University of Manitoba, Faculty of Medicine, Health Research Ethics Board for their review of this project. The Manitoba Centre for Health Policy and Evaluation complies with all legislative acts and regulations governing the protection and use of sensitive information. We implement strict policies and procedures to protect the privacy and security of anonymized data used to produce this report and we keep the provincial Health Information Privacy Committee informed of all work undertaken for Manitoba Health.

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EXECUTIVE SUMMARY

Canadian policy makers are considering a variety of new policy initiatives directed at improving the effectiveness and efficiency of health care delivery, particularly in the ambulatory setting. These initiatives include monitoring the volume and types of care provided by physicians to their patients and shifting away from fee-for-service payment to methods which pay physicians according to the number of patients in their practice – a system of reimbursement based on full or partial capitation. A critical component of these and other initiatives is the generation of reliable information about how morbidity is distributed across practice populations. Without adequate attention to methods which make it possible to adjust for differential morbidity levels and hence different "need" for services which potentially vary from practice to practice, these initiatives could discourage physicians from treating patients with serious health needs, and/or penalize the providers that care for them. The aims of this study are to see how feasible it is to measure the 'burden of morbidity' of physician practices using available administrative data, and to examine how levels of illness vary across practices in urban and rural Manitoba.

<u>Methodology</u>: The methods consist of two main parts: defining the effective practice populations of 25 large physician practices in Manitoba (15 urban and 14 rural); and quantifying illness levels among patients in these practices using demographic and diagnosis data. Because patients are not explicitly tied to practices in Manitoba, we took two different approaches to infer which patients 'belonged' to the study practices. The first method, the *plurality* method, assigned patients where they received most of their care (that is the practice where most of their expenditures were incurred). In the second, termed the *equivalent* approach, 'synthetic' practice populations were created by spreading a person's assignment across all practices they visited based on the amount of care received. Summing all patient 'parts' that were assigned to each practice created the populations.

We took several approaches to measure the morbidity levels of the derived practice populations. First, we examined the mean age, sex, and income levels (based on mean household income in neighborhood of residence) of the patients because illness is well known to vary with these characteristics. Second, we developed an 'Adjusted Clinical Group

(ACG) Morbidity Index' based on the range of different diagnoses coded on hospital records and physician claims over a one-year interval. Using these diagnoses, the ACGs group individual patients into one of approximately 100 mutually-exclusive morbidity categories which can then be aggregated to the practice level. (This morbidity index was developed for small area populations in a previous MCHPE report. (Reid et al., 1999). We also refined the index by adjusting it with regional premature mortality rates.

This study revealed some important features regarding how Manitoba practices are organized to provide care to patients and how they differ with respect to the populations they serve. The following are the study's main findings:

1. **Morbidity is not randomly distributed across practices. Some practices serve a much healthier set of patients, regardless of how patients are assigned to the practice, or how case-mix groups are weighted.**
Our study suggests substantial differences in the morbidity levels among large clinical practices in Manitoba. These differences persist regardless of whether practices are defined to include only those patients who receive the greatest share of their care at the respective clinic or whether they are defined by all the patients seen by clinic physicians. This finding suggests that attention needs to be focused on the issue of case-mix adjustment before consideration of any system of per capita payments or before practitioner performance profiles are generated. Without adequate attention to case mix, health care administrators would potentially seriously under-fund practices with sicker patients or flag them as inefficient providers. Moreover, this situation would create per capita funding incentives for physicians to encourage healthier patients to remain in their practice and to avoid/discourage the sicker ones (i.e., the phenomenon of adverse selection).

2. **The ACG Morbidity Index appears to be a useful way to examine differential morbidity at the practice level.**
The ACG morbidity index uses existing data collected routinely as part of administering the health program and can be applied to relatively small populations to

measure patient morbidity levels over short intervals. Our study suggests substantial validity of the ACG index; it varies in expected ways with other aspects of the practice population known (or hypothesized) to be related to patient morbidity including primary/specialty care mix, mean age and socioeconomic status. Several practices appear to have lower indices than would be expected, raising the possibility of less specific diagnosis coding at these clinics. We found no significant benefits of adjusting the ACG index with regional premature mortality rates. However, a useful adaptation of the ACGs as needs indicators may be to include a measure of patient socioeconomic status.

3. Larger case-mix differences exist among practices when patient "need" is measured by an index based on physician costs only versus an index of need based on both physician and hospital costs.

We found larger differences in the overall illness levels between practices when illness was estimated using an index developed from physician and hospital services combined compared to when the index was developed from physician services only. To the extent that high risk /poor health populations of low socioeconomic status tend to have fewer than expected contacts with physicians, we would expect the combined weights (based on hospital and physician costs) to somewhat adjust for an underrecording of diagnoses and more accurately reflect patient need. Alternatively, even if there were no such diagnostic underrecording, it is worth considering whether casemix adjustment weights which include hospital costs might better reflect the relative amounts of care which it is appropriate to encourage physicians to provide to high risk/poor health versus low risk/good health patients.

4. More variation exists in illness levels among urban clinics than rural ones.

Among the 15 urban clinics studied, we found more variation in overall illness levels than among the 14 rural clinics. In other words, the relatively ill or well are more likely to concentrate their care in specific clinics within the Winnipeg region than elsewhere in the province. This doesn't mean that practices outside of Winnipeg have a healthier case mix: it means that non-Winnipeg practices are more similar in their mix of healthy and unhealthy patients than are Winnipeg practices. This finding suggests that case-mix measurement and adjustment for population-based policies may be especially critical when applied to physician practices in urban areas.

5. Substantial overlap exists among practice populations and this overlap is greater for urban compared to rural clinics.

Our sample of clinics varied substantially in the degree that they 'shared' patient care with other clinics. Some clinics delivered the plurality of care to about one quarter of the patients that they see whereas some provide the plurality of care to 75% or more. This suggests that clinics vary considerably in the patient care roles they play, the strength of the relationships between patients and providers, and the degree that their patient populations overlap with those of others. This patient 'sharing' and how one deals with the "walk-in" clinic type of practice organization is an important issue when considering capitation payments or generating patient-based practice profiles.

6. Large differences exist for some clinics and small differences for others in how their illness levels compare to that of the population in the immediate vicinity.

When compared to the population in the geographic area in which the clinic is located, the overall illness levels were similar for some clinics but quite different for others. This finding implies that patients living in an area are not randomly distributed among clinics in that area and/or patients may visit clinics in other geographic areas for much of their care. This finding also suggests that case-mix adjustment approaches which include an adjustment for relative population health status in the area in which a clinic is located, may not translate adequately when applied to the physician practice level.

7. Most general and family practice physicians in Manitoba do not practice in large groups. Although not examined in this report, careful attention is necessary before applying capitation payments and/or physician profiling to small practices.

This analysis only applies to the 29 group practices in the province which have four or more general or family physicians. More than half of the provinces general and family practice physicians are therefore not included in the analysis. Although not examined, the measurement of morbidity in small practices is difficult because of their increased susceptibility to the effects of misclassification and random error. That is a small number of patients can greatly skew results. While U.S. researchers have applied ACGs for practice populations as low as 400 patients, more research is required to validate the ACGs for small practices.

1.0 INTRODUCTION AND BACKGROUND

With the implementation of new policy initiatives, understanding the distribution of morbidity in populations and the resultant needs for health care is becoming increasingly relevant to Canadian health care policy makers and managers. In the last decade, rising budgets have forced governments to seek ways to improve system effectiveness and efficiency, including changing the contexts where care is delivered and influencing the decisions that patients and practitioners make in seeking and providing care. Changing the context of care has largely meant shifting from hospital to less expensive ambulatory care settings, regionalizing services to respond to local needs and concerns, and integrating services across the continuum. Policies aimed at influencing care decisions include monitoring physicians' practice patterns and costs and experimenting with alternative payment mechanisms. Obviously, a critical concern in applying these strategies is that they align closely with the goal of equity, a main objective of Canadian health care. Since equity implies that those with more health care needs receive a disproportionately larger share of resources (Mooney 1987), a central part of these initiatives is the generation of reliable information on how morbidity is distributed across populations.

The focus of this report is measuring morbidity and need for health care in populations at the level of the physician practice–a place that the majority of Manitobans visit for their medical care every year and that serves as the main portal into the health care system. In other words, do the overall illness levels of physicians' practice populations differ and if so by how much? Understanding how morbidity is distributed across physician practices is critical to the application of population-based initiatives under consideration in a variety of provinces. The first policy being contemplated (or in some cases already applied) is the shift from fee-for-service (FFS) payments to full or partial capitation funding (Hurley et al. 1999). A variety of professional groups and health policy organizations have endorsed rostering and capitation financing as a strategy to improve primary care (Ontario Health Services Restructuring Commission 2000; Commission d'étude sur les Services de Santé et les Services Sociaux 2000; Ontario Ministry of Health 1996; Ontario College of Family Physicians 1999; Federal/Provincial/Territorial Advisory Committee on Health Services 1995; Ontario Medical Association 1997). Primary care reforms based on capitation funding are underway in a variety of provinces including Alberta, British Columbia, Ontario and Saskatchewan (Hutchison et al. 1999). As opposed to FFS where physicians are compensated after each time they perform a service, capitation funding means that physicians provide their patients with a fixed basket of services for a predetermined and periodic payment. To be equitable, however, these payments must adequately reflect differences in the morbidity and health care needs across physician practices. Obviously, physicians with sicker patients will be required to provide more care than physicians with healthier ones and thus they should be compensated accordingly.

Without adequate attention to differences in case-mix, capitation funding could potentially be highly inequitable by directing funds away from sicker populations and by under-compensating the providers who care for them. Moreover, a perverse incentive is created to select the healthiest patients for a provider's panel and to avoid the sickest ones. This phenomenon is known as 'favorable' selection.

The second policy where adequate appreciation of morbidity is essential is the use of practice 'profiling' where utilization and costs are compared among physicians and physician groups. This technique compares the actual costs of a physician's patient panel with what would be expected if the panel received average care from the physician's peers (Hendryx et al. 1995; Lasker, Shapiro, and Tucker 1992). Practitioner practice 'profiles', produced at regular intervals, show physicians if their care patterns depart from those of their peers and lead them to reconsider or identify reasons why this might be appropriate (Krentz and Miller 1998). (In British Columbia, case-mix adjusted 'practitioner profiles' have been used to compare physician utilization and costs since 1997 (British Columbia Medical Services Plan 2000). However, if a physician's practice is significantly sicker than his or her peers, unadjusted (or inadequately adjusted) profiles could inappropriately 'flag' these practitioners as inefficient (Salem-Schatz et al. 1994). A comparison of unadjusted costs and utilization profiles is generally considered a flawed gauge of physician performance because it fails to account for important differences in the patient panels associated with certain physicians or physician groups.

Another potentially important application of techniques to measure morbidity in clinical populations is in physician resource planning at the practice level. A persistent quandary in managing care in the ambulatory environment is how to align a practice's human resources with the demand for physician time (Roblin 1996). Part of deciding how many physician FTEs are required to provide care for a practice's patients requires the measurement of the case-mix of practice panels, the principal influence on demand.

Despite the critical role that morbidity plays in the application of these and other policies to improve efficiency and equity, very little understanding exists about how case mix varies among physician practices in Canada in general and in Manitoba specifically. This study intends to help fill this gap. The two aims are:

1. To see how feasible it is to measure the 'burden of morbidity' of physician practices in Manitoba using available administrative data
2. To examine how levels of morbidity and other patient factors vary across practices in urban and rural Manitoba

The Challenge of Measuring Illness and Medical Care Needs in Physician Practices

For physicians and other health care personnel, the assignment of diagnoses is the principal way that illness is classified and quantified. Diagnoses are key to how physicians organize their care – diagnoses suggest appropriate investigations and interventions, imply the types of providers who should be involved (e.g., specialists, nutritionists, and physical therapists), suggest the appropriate care settings, (e.g., inpatient care and day surgery) and define the duration of treatment (e.g., antibiotic treatment). They also provide a way for physicians to 'benchmark' a patient's progress over time and suggest appropriate avenues for follow-up. Thus, since diagnoses form the cornerstone in how physicians and patients define health service needs over time, it is logical one would want to account for differences in the types of diagnoses that describe patients treated when designing a new payment system or a system for monitoring patterns of practice.

While assigning diagnoses is vital for physicians to plan the care they provide, many challenges exist in using diagnoses to describe aggregate health care needs in clinical populations. At the practice level, a simple count of certain diagnoses (such as diabetes mellitus, ischaemic heart disease, schizophrenia, or upper respiratory infections) does not give an adequate description of resource needs. Not only is the range of illnesses that one must count vast (i.e., over 16,000 different diagnoses are captured by the International Classification of Diseases version 9) but patients often have coexisting morbidities which can have a multiplicative effect on health service needs. No simple way exists for aggregating needs for particular patients into an aggregate score, nor is there any easy way to sum diagnoses for populations of patients.

The search for methods to measure morbidity and medical need for patient populations, particularly unstable populations and those not defined by geography, remains an ongoing challenge for researchers. Probably the most widely used approach is to define relative need of populations using patients' sociodemographic attributes as proxies for illness. Since these variables (including age, sex, income level, education, occupation, social support, and environmental attributes) are highly related to the occurrence of many morbidities, they have been used by some countries to differentiate populations of high vs. low need. In Manitoba, age and sex are routinely collected in administrative data banks but by themselves these variables are inadequate in differentiating medical related needs. Other variables such as socio-economic status which are known to be related to health status, are either unavailable (e.g., occupation) or are available only at census-level aggregations (i.e., neighborhood income) limiting their utility for practice populations not defined by geography.

The second approach uses mortality as a proxy, based on the premise that high mortality reflects poor health status and greater health care needs. The premature mortality rate (deaths before the age of 75 years) is generally considered to be the best single proxy of overall population health needs that is currently available (Carstairs and Morris 1989; Eyles and Birch 1993; Roos and Mustard 1997; US General Accounting Office 1996). Although premature mortality is not linked to all types of health service needs (e.g., preventive care needs), it is thought to be a reasonable indicator of need because of its relationship with those illnesses associated with sizeable and ongoing resource implications (Eyles et al. 1991). The main disadvantage of using mortality in physician practices is that it requires long data collection periods (e.g., five years) for small populations and thus is insensitive to changes over shorter intervals. The third approach is to survey patients and ask about their general health status and/or periods of disability. Populations where patients rate their overall health as poorer or are disabled for longer periods are considered to have greater overall needs for health interventions. While used as the 'gold standard' by some researchers (Hutchison et al. 2000), in practice these methods are impractical because surveys are not routinely administered and are expensive to conduct.

The final approach is the 'case-mix' method where patient diagnoses taken from ambulatory and hospital records are grouped into similar categories of health service resource requirements (Starfield 1998). While many diagnosis 'grouping' methods categorize morbidity for particular episodes of illness, a new class of tools have emerged that groups individuals into case-mix categories based on their complement of diagnoses over extended periods of time. These measures can be aggregated over practice populations. Most prominent among these diagnosis grouping systems are the Diagnosis Cost Groups/Hierarchical Coexisting Conditions (DCGs/HCCs) system (Ash, Ellis, and Yu 1997; Pope 1997), the Adjusted Clinical Group (ACGs, formerly the Ambulatory Care Group) system (Starfield et al. 1991; Weiner et al. 1991), and the Disability Payment Group (DPGs) system (Kronick, Dreyfus, and Zhou 1996). These types of measures have distinct advantages in assessing the morbidity characteristics of practice populations in that they can be applied to relatively small populations and over short intervals (as little as six months). Moreover, the diagnoses necessary to fuel these tools are routinely collected on most provinces' ambulatory and inpatient records. In this study, we have selected the ACG system as the main method to describe morbidity across Manitoba practices. The ACGs were chosen because: 1) they were originally developed as a case-mix system for ambulatory populations (and only subsequently extended to institutional care); 2) they are theoretically aligned with the concept of need based on opinions of expert clinicians buttressed by empirical analyses; and 3) they have been shown to perform reasonably well in accounting for use and costs at the individual level (Reid et al. 2001a), and in aligning with other measures of need used for describing populations (Reid et al. 2001b). The ACG system is briefly described in Section 2.3.

While ACGs are useful in providing an assessment of the overall morbidity burden of a practice, they do not however provide estimates of how often various diseases occur. Disease specific frequencies are very important in determining precise resource requirements and implementing quality assurance systems. The generation of disease-specific indicators, however, was beyond the scope of this report.

It is important to note in this report we apply ACGs solely for researcher purposes - as a way to measure overall illness levels in Manitoba practices. As described above, ACGs can also be used as real life health care management tools to direct funds or profile efficiency. We are not recommending our way of applying ACGs for these purposes.

2.0 MEASURING MORBIDITY IN PRACTICE POPULATIONS: METHODS AND RESULTS

The following sections of this report examine issues involved in quantifying the demographic and morbidity characteristics of physician practice populations in the province of Manitoba. Section 2.1 outlines our approach to identify physician practice populations. Obviously this is an essential component to any measurement exercise since the decision about which patients are part of a physician's or group's practice can affect how their case-mix is described. In Section 2.2, we build on these practice definitions and examine how key demographics vary across a selection of large Manitoba practices, including age, sex, socioeconomic status, and region of residence. In Sections 2.3 and 2.4, we develop a series of 'morbidity indices' for these practices based on the clinical case-mix groupings of the ACG system. As discussed above, because the ACGs classify patients' composite diagnosis patterns over time, they provide a useful method for estimating the burden of illness for physician practice populations. We examine the variability of illness burdens across practices and examine aspects of the index's validity. We also examine the effect of using different practice definitions and weighting approaches. Finally, Section 2.5 examines how the illness level in a group practice compares with that in the local population.

2.1 Defining Practice Populations

To profile the demographics and illness levels for physicians' practices, a definition of the practice population is required. In health systems where patients are formally assigned to particular providers or groups of providers (such as in U.S. managed care organizations [MCOs] and many European health systems), this is a relatively simple task. Patient 'lists' are used to define the populations and then profiling is based on administrative and clinical records. The main methodological issue in defining these patient populations results from differences in the length of time patients are enrolled with the practices for such reasons as death, relocation, and patient choice.

In most Canadian settings (including Manitoba), open access is the rule and patients are free to choose their physician at point of service. Defining a practice's effective patient population is a much more complicated task. Patients may visit different practices concurrently and over time. No formal 'lists' exist and both patients and physicians only implicitly define practices. The simplest way to link patients with practices would be to ask patients to identify their preference of physicians and/or practices. However, this type of survey data is unavailable in all but small population samples. Instead, researchers and health administrators have relied on prior utilization data to infer which physicians and groups that a patient considers his or her 'own'. (Practice rosters based on prior utilization data are also called 'informal' 'virtual' or 'passive' rosters.) For patients who make multiple visits to only one clinic in the course of a year, this is a straightforward process. But what about a patient who makes three visits to one clinic and two visits to another? Should he or she be included only on the first practice's 'virtual' roster? And how about a patient who makes a single visit to a first clinic but four to a second and five to a third? Is it reasonable to count this patient as part of the first clinic's population even though the clinic provided a small minority of care? And what about a person who only makes one or two visits to the same physician in a year - is it reasonable to assume an ongoing physician-patient relationship? And finally, what about the 'non-user' individual who has no prior utilization data from which physician preferences can be inferred? One can clearly see from these examples that the determination of a practice's population from prior use data quickly becomes problematic, particularly for multiple physician users, low-users and non-users.

The approaches used to assign patients to practices in this report were guided by techniques used by previous researchers (Kasper 1987; Weiner et al. 1995) and extends prior work done at MCHPE (Menec et al. 2000). Two principles guided our selection and application of methods. First, we wanted to assign patients to practices based on the amount of care provided at different sites. In other words, we sought to allocate patients based on how their care was distributed across the range of physician practices. We used expenditures on physician and hospital services to quantify the link between patients and practices (rather than numbers of visits, sequence of visits, or other criteria) under the assumption that expenditures were best able to reflect differences in the quantity of care provided. We recognize, however, that this method gives more weight to procedures and specialized services than to cognitive services. As a result, patients may be more likely assigned to multidisciplinary clinics because this is where they receive diagnostic testing and therapeutic interventions. Second, we based assignments on the principal of a 'closed' system. In other words, we wanted to ensure that, after assigning all health system users to physician practices, no individuals would be left unassigned and none assigned more than once.[1]

To meet these criteria, we selected two assignment approaches, termed the *plurality* and *equivalent* approaches, and applied them to our sample of Manitoba practices based on expenditure data from fiscal year 1995/96 (April 1, 1995 -March 31, 1996). For the remainder of this report, we examine the characteristics of the practice populations using both methods, examining similarities and differences in the results obtained. For the plurality approach, patients are assigned to that practice where they receive the *greatest* single portion of their care (i.e., the most expenditures). Using this method, patients are assigned exclusively to one practice. A practice is 'credited' with a patient if the practice delivers more care than does any other and no credit is given if more care is delivered at a practice elsewhere. For example, if a patient receives 60% of his or her care from one practice, 20% from a second, and the remaining 20% from a third, he or she is assigned exclusively to the first practice. The practice's size is simply the sum of patients who obtain the greatest proportion of their care at the clinic. This 'whole patient' approach is a widely used method for patient assignment in non-enrolled populations[2] and is consistent with the orientation of capitation funding where practices are paid per capita whether patients use services at a clinic or not.[3] Furthermore, the advantage of using this method is that the profiles align with the principles of primary care (Canadian Medical Association 1994; Institute of Medicine 1996; Starfield 1994) where a physician's responsibility is to integrate

[1] We were not able to consider the assignment of 'non-users' to practices because, by definition, they had no utilization data on which to base our inferences. The issue of how to assign non-users to practices, however, is critical in establishing patient rosters for capitation payments and in assessing whether needed services were not provided. Furthermore, it is important to understand the morbidity characteristics of patients that do not use services and the reasons underlying their non-use. However, consideration of non-users was beyond the scope of this report.

[2] This method is similar but not identical to the 'majority source of care' (MSOC) method (and its variants) used by Menec(Menec et al. 2000). With the MSOC method, patients are *only* assigned to practices if they receive *most* of their care in one particular site. The plurality and MSOC assignment methods are identical for patients who receive more than half their care at any one practice. However, if less than 50% of care is obtained in any one clinic, the plurality method would make assignments based on the highest percentage whereas the MSOC method would leave them unassigned. Thus, the MSOC approach did not fulfill our desire for assigning all users to a practice.

[3] Capitation arrangements are obliged to account for out-of-practice costs which may sometimes be subtracted (i.e., negated) from future capitation payments.(Hurley et al. 1999).

and organize care across visits, illnesses, and care sites for a defined population. By limiting the practice definition to plurality patients, physicians are credited with patients whose care they were in large part responsible. The main disadvantage of this approach is that it does not consider patients whose plurality of care is delivered elsewhere. For clinics that deliver a large portion of care to their patients, this is not a large problem. However, for clinics providing care to patients who are not largely 'their own' (e.g., an off-hours 'walk-in' urgent care clinic), any practice-based profiles may be based on a relatively small percentage of the patients they see. Thus, this assignment approach may arguably lead to an under- or over-estimation of the morbidity burdens for these types of clinics.

In contrast to the plurality approach, the second approach used - the equivalent approach - 'spreads' patient assignments across all the practices visited in a defined interval. (In our application of this method, expenditures are used to 'weight' the assignments.) As opposed to the plurality approach, patients (or at least 'parts' of patients) can be assigned to multiple clinics. For example, if a practice delivered 50% of the care to one patient, 80% to a third, and 20% to a third, the clinic would be assigned a total of 1.5 'equivalent' patients. Using this approach, 'synthetic' populations are created for each practice based on adding portions of all patients that visited that practice. The advantage of this approach is that it reflects all care provided at the practice regardless of where patients received their plurality of care. The main disadvantage stems from the assumption that patient characteristics (including morbidity) have the same distribution across practices as expenditures. This assumption is hazardous given that expenditures are related to many other factors in addition to patient factors. For example, practices that have a higher than average patient recall rate for patients seen only casually at the clinic may be assigned a relatively large portion of the patients morbidity and thus may be rewarded for this practice pattern.

Table 1 shows how these assignment approaches would operate for a hypothetical practice (Clinic A) with 5 different 'discrete' patients making visits over the course of a year. A 'discrete' patient is defined as any patient with a visit to a particular practice over the study year. In this example, there are two competing practices that patients may also visit. Based on summing the actual costs of care over the year (fee-for-service physician payments in this

Table 1: An Example of how Patients are Assigned to a Hypothetical Practice

Patient Characteristics			Patient I	Patient II	Patient III	Patient IV	Patient V	Clinic Total
Age (y)			45	26	5	63	34	-
Sex			M	F	M	M	F	-
Residential Physician Service Area (PSA)			K1	K1	K1	C	T	-
Ambulatory Care Group (ACG)			900	1600	200	4420	3400	-
Ambulatory Costs ($)	Total	(A)	160	30	100	300	100	-
	Clinic A	(B)	128	30	40	120	20	-
	Oth Clinic B	(C)	0	0	60	100	0	-
	Oth Clinic C	(D)	32	0	0	80	80	-
Patient Assignment (Clinic A)	Discrete	(E)	1	1	1	1	1	5
	Plurality	(F)	1	1	0	1	0	3
	Equivalent	(G)=(B/A)	0.8	1	0.4	0.4	0.2	2.8

example), patients I, II, and IV went to Clinic A for greatest proportion of their care (80%, 100% and 40% respectively). Thus, under the plurality approach, Clinic A would have a total population of 3 patients. (Although clinic A delivered 40% of care to patient III, he or she received 60% from Clinic B.) Using the 'equivalent' approach, all five patients were weighted by the proportion of care delivered by Clinic A, creating a synthetic population of 2.8 patients.

Table 2 shows the patient assignments using the different approaches in FY 1995/96 for the 29 large Manitoba practices (14 rural and 15 urban) identified by Menec (Menec et al. 2000)[4] Essentially these were groups with four or more general practitioners or family practitioners. (See Appendix A for a description of the methodology used to select these practices.) In these analyses, assignments were based on the fractions of two subsets of health-related expenditures - 'physician' and 'total' (physician and hospital) expenditures attributed to the practice's physicians. Physician costs included all payments made to Manitoba physicians in 1995/96 for clinical care (fee-for-service payments and 'shadow' claims submitted by salaried physicians), excluding isolation allowances and other surcharges. Costs were attributed to practices based on the practice site code from the billing physician. 'Total costs' included physician and hospital related expenses relating to inpatient care and ambulatory surgery. Because Manitoba hospitals are globally funded, we estimated hospital costs using refined diagnosis-related groups (RDRGs) and day procedure groups (DPGs) (Canadian Institute for Health Information 1994b; Canadian Institute for Health Information 1994a) together with Manitoba cost estimates for 1995/96 (Shanahan et al. 1999). Hospital costs were attributed to the physician (and his or her practice) recorded as the attending physician on the discharge abstract. (See Appendix B for details of hospital costing.)

Across the 29 clinics, the number of patients that who had at least one contact with clinic physicians over the course of the 1995/96 year ranged from 110,313 in the largest urban clinic (U1) to 3,849 in the smallest rural one (R14). This almost 30-fold difference suggests considerable differences in the number of physicians practicing out of the clinics and the types of care that they delivered. Four very large urban clinics saw disproportionately more

[4] Urban clinics included those in Winnipeg and Brandon.

patients than the remaining clinics (i.e., >40,000 patients). In three of these clinics (U1, U2, U4) consultations by specialists in the group accounted for more than 7% of all visits delivered by the group, indicating a greater mix of primary and specialist referral care. The remaining urban practices (where visits were almost entirely non-consultative in nature) generally saw more discrete patients than did the rural practices

Table 2: Practice Populations and Proportion Consultative Visits, 1995/96

		Practice Populations*					
			Plurality Assignment Patient Counts		Equivalent Assignment Patient Counts		
		Discrete Patients	Using Physician Costs	Using Total Costs	Using Physician Costs	Using Total Costs	Consultative Visits (%)
Urban Clinics	U1	110,313	48,271	46,396	39,794	40,287	15.0
	U2	101,004	49,629	49,916	40,438	43,047	16.0
	U3	71,712	19,290	19,081	20,151	20,199	2.1
	U4	44,808	26,499	26,082	22,772	23,227	7.8
	U5	21,126	11,890	11,894	10,302	10,634	2.9
	U6	20,511	6,174	6,232	6,327	6,331	0.0
	U7	17,654	8,015	7,893	7,471	7,417	0.0
	U8	17,110	5,624	5,665	5,516	5,531	0.0
	U9	16,918	5,334	5,225	5,253	5,144	0.1
	U10	15,912	8,040	7,861	6,885	6,788	0.0
	U11	15,661	4,094	4,025	4,369	4,271	0.1
	U12	13,030	6,694	6,740	5,560	5,627	2.0
	U13	10,791	2,861	2,804	3,056	2,986	0.0
	U14	10,401	2,711	2,673	2,987	2,923	0.0
	U15	7,901	3,280	3,170	2,930	2,838	0.0
Rural Clinics	R1	23,417	16,076	16,115	14,836	15,177	0.4
	R2	20,084	12,624	12,598	11,462	11,746	2.5
	R3	16,601	10,525	10,235	9,423	9,493	4.0
	R4	11,155	6,722	6,557	6,501	6,361	1.2
	R5	10,722	7,726	7,655	7,249	7,325	3.2
	R6	10,235	6,528	6,683	6,139	6,396	0.5
	R7	8,525	5,037	4,947	4,453	4,477	0.0
	R8	6,825	3,395	3,357	3,362	3,360	2.4
	R9	6,489	3,814	3,812	3,482	3,537	0.2
	R10	6,358	3,713	3,746	3,466	3,570	0.1
	R11	6,143	3,691	3,657	3,292	3,349	0.7
	R12	5,613	3,635	3,617	3,294	3,375	0.1
	R13	5,181	3,346	3,359	3,153	3,200	0.1
	R14	3,849	2,418	2,431	2,136	2,230	0.5

* Number of patients using different assignment methods. 'Discrete' refers to a number of patients with at least one contact to clinic in 1995/96. 'Plurality' refers to assignment based on practice where patient received plurality of costs ('physician ' or 'total' costs). For 'equivalent' approach, patients are weighted by proportion of costs attributed to practice
** Percent or consultative visits billed by specialists relative to all visits made to clinic in 1995/96.

The use of plurality and equivalent assignments substantially reduced the patient populations for all clinics from what clinics might think was on their 'roster' based on the numbers of discrete patients who contacted them during the year. This finding implies considerable overlap in patient populations among clinics, with multiple clinics 'sharing' the care of many patients (Figure 1). However, even after the plurality and equivalent assignments, there remained considerable variation in the size of the patient populations. Patient counts ranged 20-fold using the plurality approach (48,271 to 2,418) and 19-fold with the equivalent approach (39,794 to 2,136). For most practices, the two approaches produced very similar patient counts - differing by less than 15%. It is important to note that, while the counts are similar, they do not necessarily reflect the same patients; the plurality approach reflects a subset of the discrete patients while the equivalent approach reflects a portion of each discrete patient that the clinic sees, and accumulates these to full-time-equivalent patient totals.

Figure 2 presents the ratios of the plurality and equivalent patient counts to the total number of patients seen at the clinics. These ratios are one measure of the degree to which the clinics provide the totality of care for all patients that they see. For instance, if a clinic has a ratio comparing plurality to discrete counts of 0.5, this means that that clinic only provided the plurality of care for half of all the patients that visited in that year. Three observations are apparent from the figure. First, substantial variability exists in the ratios showing that some clinics provide a plurality of care to most patients they see whereas some clinics provide only a minority of care to most patients. This implies that practices differ in important ways in how they serve their patient populations, the 'strength' of the relationships between providers and patients, and the degree to which their patient populations overlap with those of others. This overlap is significant in designing a patient-based profile system that accounts for patient 'sharing' or in enrolling persons with certain practices for the purposes of capitation payments. Some of the explanation for this overlap is because of our lack of differentiation between consultative and non-consultative care (i.e., clinics deliver up to 16% specialty referral care).

Figure 1: Comparison of Practice Populations using Different Patient Allocation Methods, 1995/96

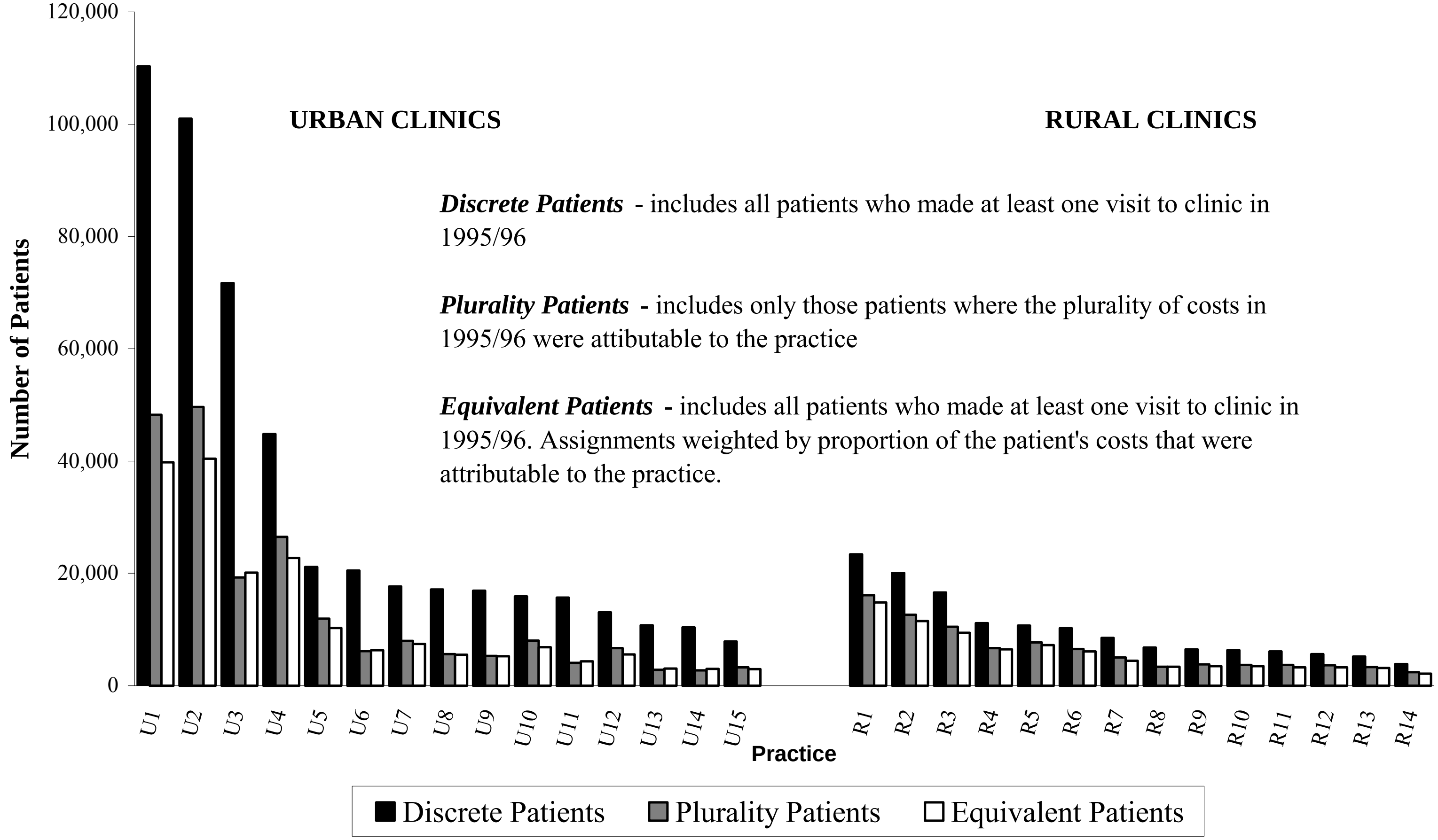
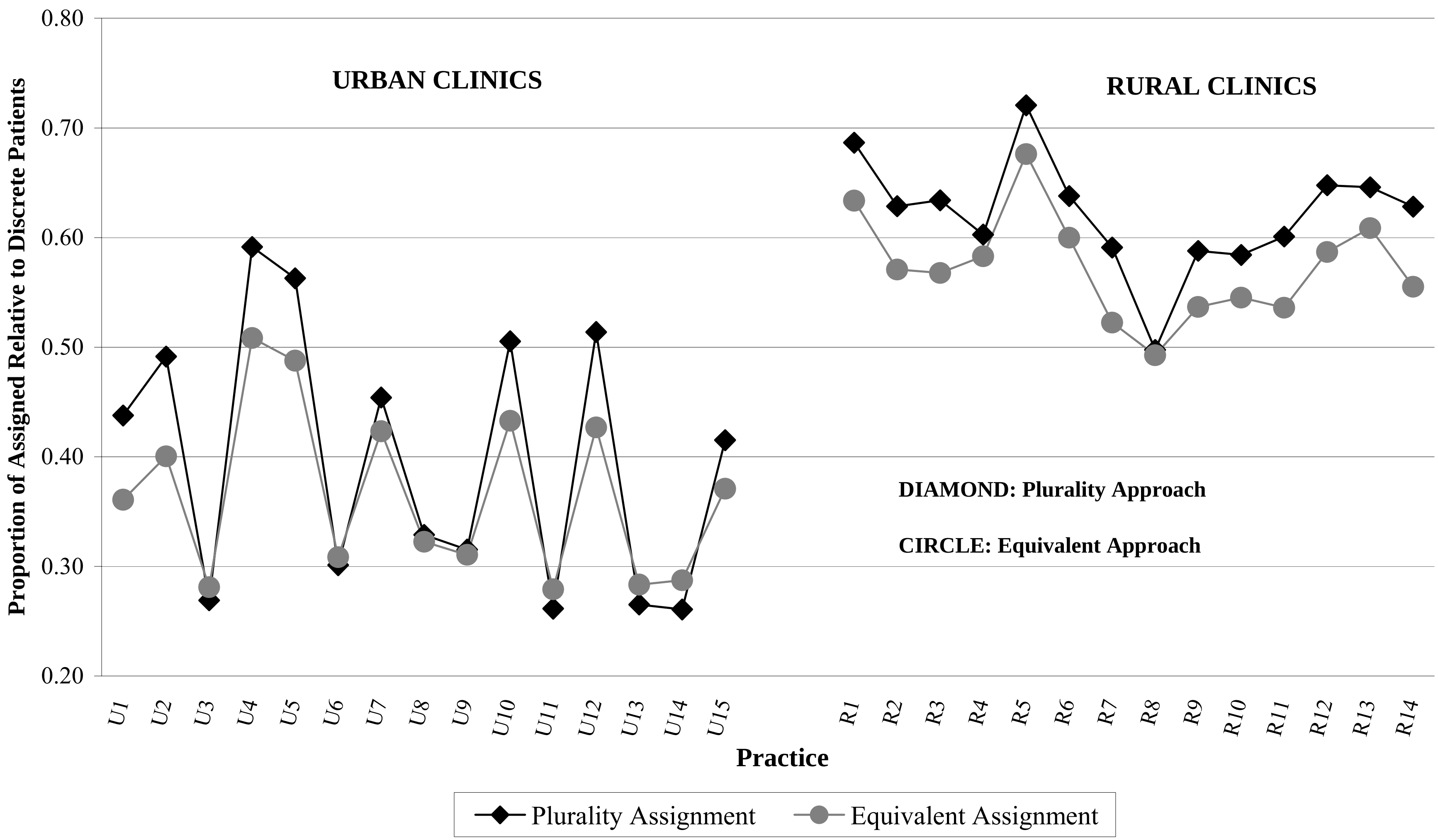


Figure 2: Comparison of Patient Assignment Approaches
(*based on Distribution of Physician Costs*)



For instance, some patients may be receiving primary care from one practice, specialty medical care from another, and obstetrical care from a third. Further research is required to understand other reasons that many patients visit multiple practices over the course of a year.

Second, the ratios are almost uniformly higher in rural sites compared with urban ones. In fact, all of the rural clinics deliver the plurality of care to over 50% of their patients compared to less than one third of the urban ones. Menec et al found similar results using variants of a 'majority source of care' rule to define patient populations (Menec et al. 2000). The reasons underlying this urban/rural difference are speculative but, in part, reflect the fewer choices of primary care physicians and the lesser accessibility of specialty referral care in rural areas (Roos et al. 1999a; Roos et al. 1999b). Several urban practices (U6, U11, U13, and U14) without a specialty care component provide the plurality of care to fewer than 30% of all the patients they see. This finding is consistent with the provision of 'walk-in' urgent care.[5] Careful attention needs to be given to how these types of clinics would be affected by capitation funding and profiling. Third, for most clinics (but not all) the plurality counts are greater than the equivalent counts. This implies that for those patients receiving the plurality of care at one clinic, many also receive a significant proportion of their care elsewhere.

Figures 3 and 4 show the differences in these ratios when total costs rather than physician costs were used in the plurality and equivalent assignments. By including hospital costs in the assignment process, patients are more likely assigned to physicians (and their clinics) who were identified as attending during episodes of hospitalization. On the whole, however,

[5] While not the focus of this report, the finding of clinics that are devoted to providing a small proportion of care to patients seeing other providers raises several interesting questions regarding their role in delivering primary care. Why do patients seek services from these clinics? Is it because their 'regular' providers are inaccessible at times that patients require care? Do physicians recognize that patients are obtaining care elsewhere? How is the totality of their care integrated? Do these clinics communicate effectively about management approaches and requirements for follow-up? Do recommended services (i.e., preventive services) sometimes 'fall into the cracks' because responsibility for patient care is dispersed?

Figure 3: Comparison of Patient Assignment Approaches
Plurality of Physician Costs vs. Plurality of Total Costs

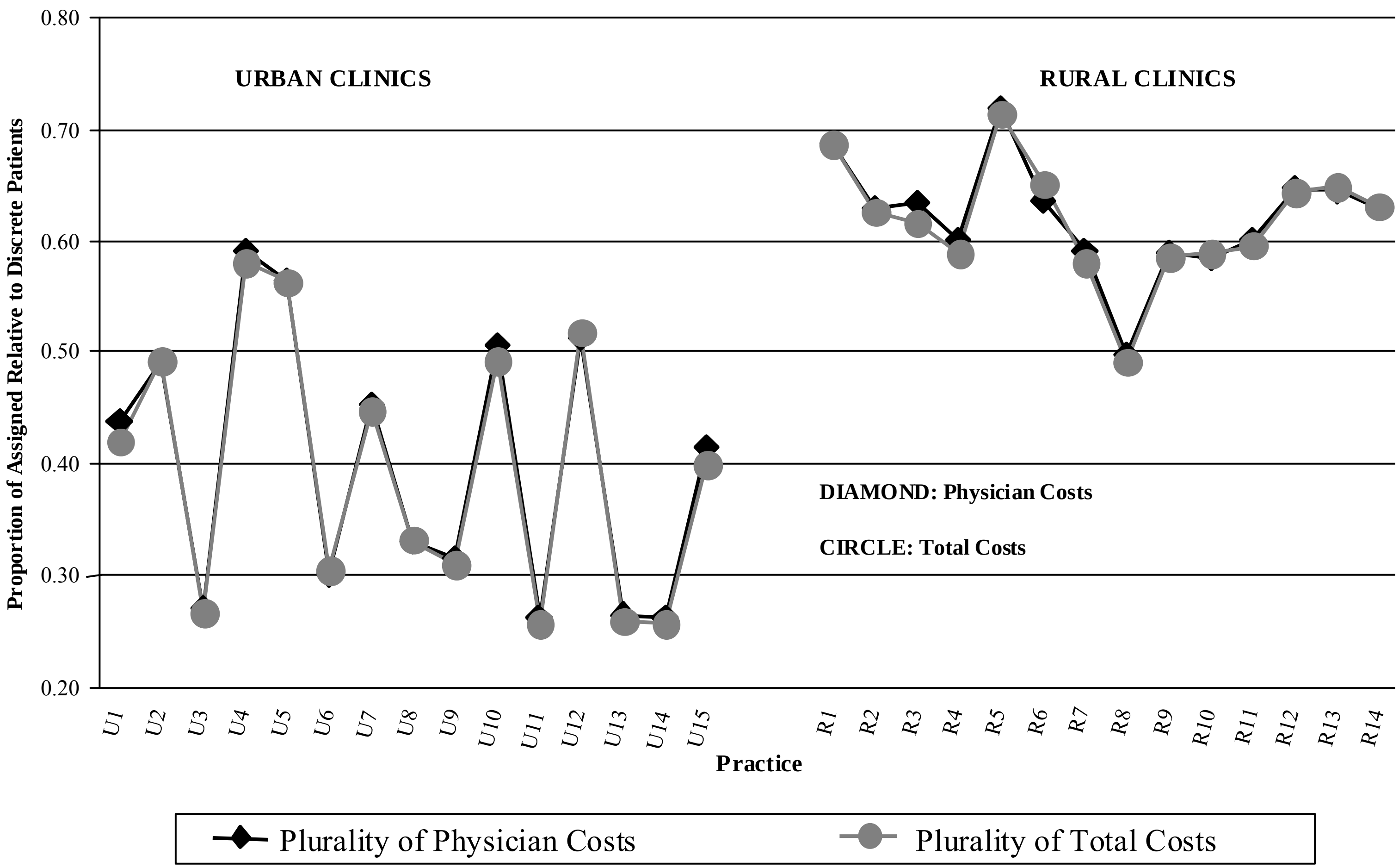
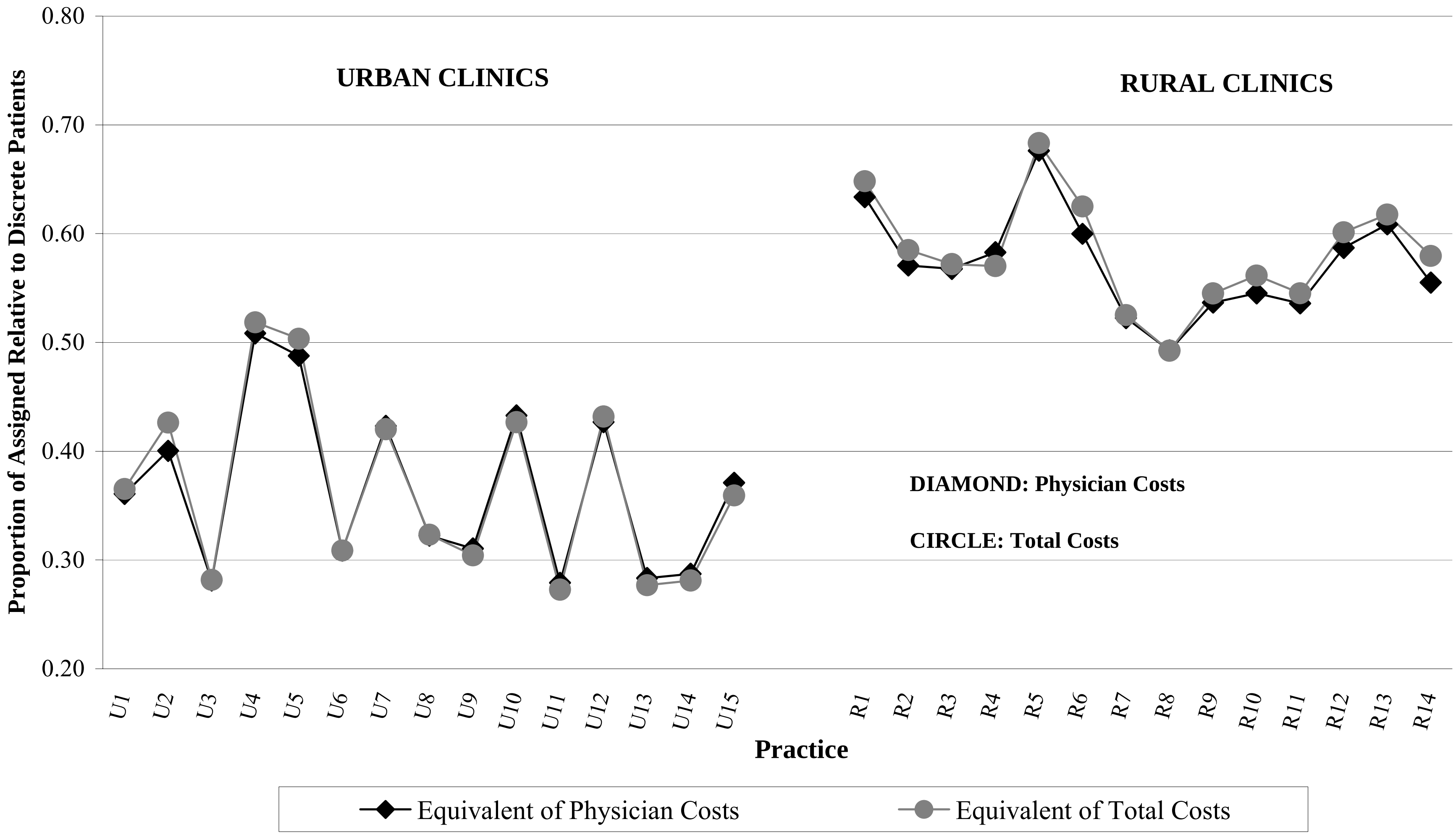


Figure 4: Comparison of Patient Assignment Approaches
Equivalent of Physician Costs vs. Equivalent of Total Costs



there were few differences in the population counts using the two assignment methods. Moreover, the numbers obtained with the plurality and equivalent approaches converge when total costs are used.

2.2 Demographic Variability in Manitoba's Large Physician Practices

Table 3 shows the demographic characteristics of the plurality patient populations for the 29 study practices. Some practices were significantly older than others with the mean age ranging from 24.6 to 43.1 years (mean 35.3 years; sd 5.52 years) suggesting considerable differences in health status and clinical needs (Figure 5). Furthermore, some practices catered more to women than to men and vice versa. In one suburban Winnipeg clinic (U15), more than three quarters of all their plurality patients were female.

As a measure of socioeconomic status, the mean income quintile of the practice populations is also presented. Residents were divided into five equal-sized groups based on average neighborhood household income data derived from public use census data. Residents of the highest income neighborhoods were assigned a 5 and those of the lowest income neighborhoods, a 1. This was done separately for urban and rural residents since urban incomes tend to be higher. The average of these neighborhood income rankings was calculated for all plurality patients assigned to a practice. As is evident, there is considerable variation in mean quintile ranks among the clinics (particularly those in rural Manitoba.) We know from Table 3 that rural clinics draw their patients more predominantly from their local physician service area (PSA)[6] while urban clinics tend to draw from across the city. While we have not investigated this directly, it may be that the rural areas consist socioeconomically of more homogenous populations – relatively more or less affluent, depending on where in the province the clinic is located. Given the close relationship between socioeconomic status and health status, this finding also suggests considerable differences in health needs among the clinics.

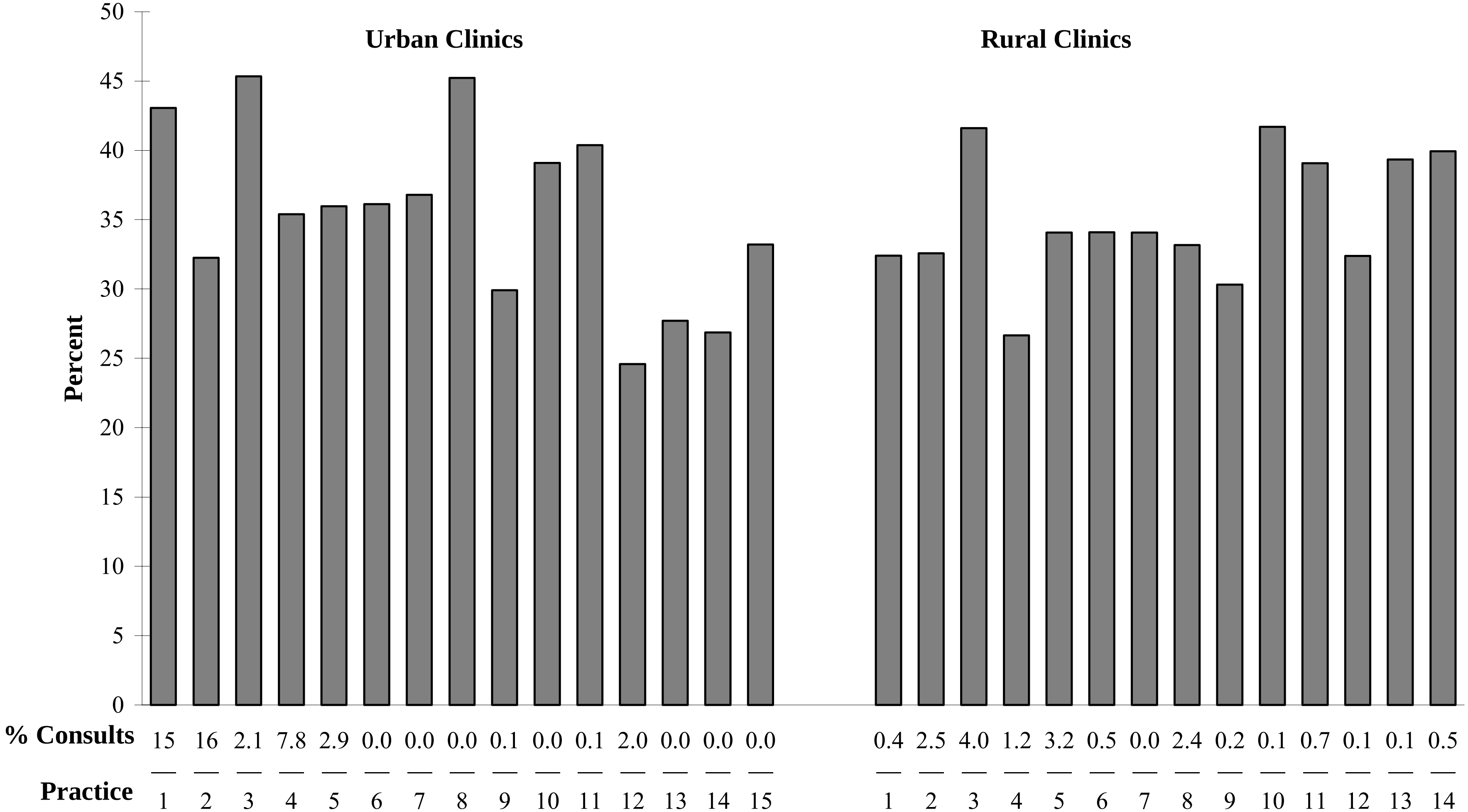
[6] Rural physician service areas are groupings of areas within Regional Health Authorities, according to where residents go for physician services. These areas typically include the towns in which a group of physicians practice, plus the smaller nearby communities and districts whose residents seek care from these physicians. Winnipeg however has been divided into nine areas reflecting logical groupings of area residents according to socioeconomic characteristics obtained using public consensus data. Both of these groupings have been used in previous MCHPE reports.

Table 3: Demographic Characteristics of Practice Populations, 1995/96

		Age (mean)	Female (%)	Income Quintile (mean)	% Dominant PSA
Urban Clinics	U1	43.1	53.2	3.2	18.8
	U2	32.3	57.4	3.1	19.2
	U3	45.3	55.4	3.7	50.6
	U4	35.4	55.9	2.7	67.5
	U5	36.0	60.4	2.7	79.6
	U6	36.1	47.7	3.1	52.6
	U7	36.8	47.3	3.4	74.0
	U8	45.2	52.7	3.0	25.4
	U9	29.9	43.0	3.6	68.1
	U10	39.1	50.9	4.1	61.5
	U11	40.4	46.0	2.6	20.6
	U12	24.6	48.2	3.9	53.7
	U13	27.7	51.7	2.6	29.0
	U14	26.9	50.8	3.2	59.1
	U15	33.2	81.8	3.9	36.3
Rural Clinics	R1	32.4	53.3	2.5	79.9
	R2	32.6	52.0	3.2	78.2
	R3	41.6	55.2	2.0	65.4
	R4	26.7	51.9	1.7	33.5
	R5	34.1	51.9	2.3	81.1
	R6	34.1	56.2	2.3	74.6
	R7	34.1	48.3	3.7	58.8
	R8	33.2	50.8	2.8	46.9
	R9	30.3	50.4	2.8	86.9
	R10	41.7	51.9	2.0	93.3
	R11	39.1	54.1	2.3	65.5
	R12	32.4	51.1	1.5	77.1
	R13	39.3	50.4	1.8	86.8
	R14	39.9	52.9	3.7	84.8

Patient assignments based on plurality of physician costs.
Income refers to rural/urban income quintile of patient.
PSA = Physician Service Area

Figure 5: Mean Age of Practice Populations



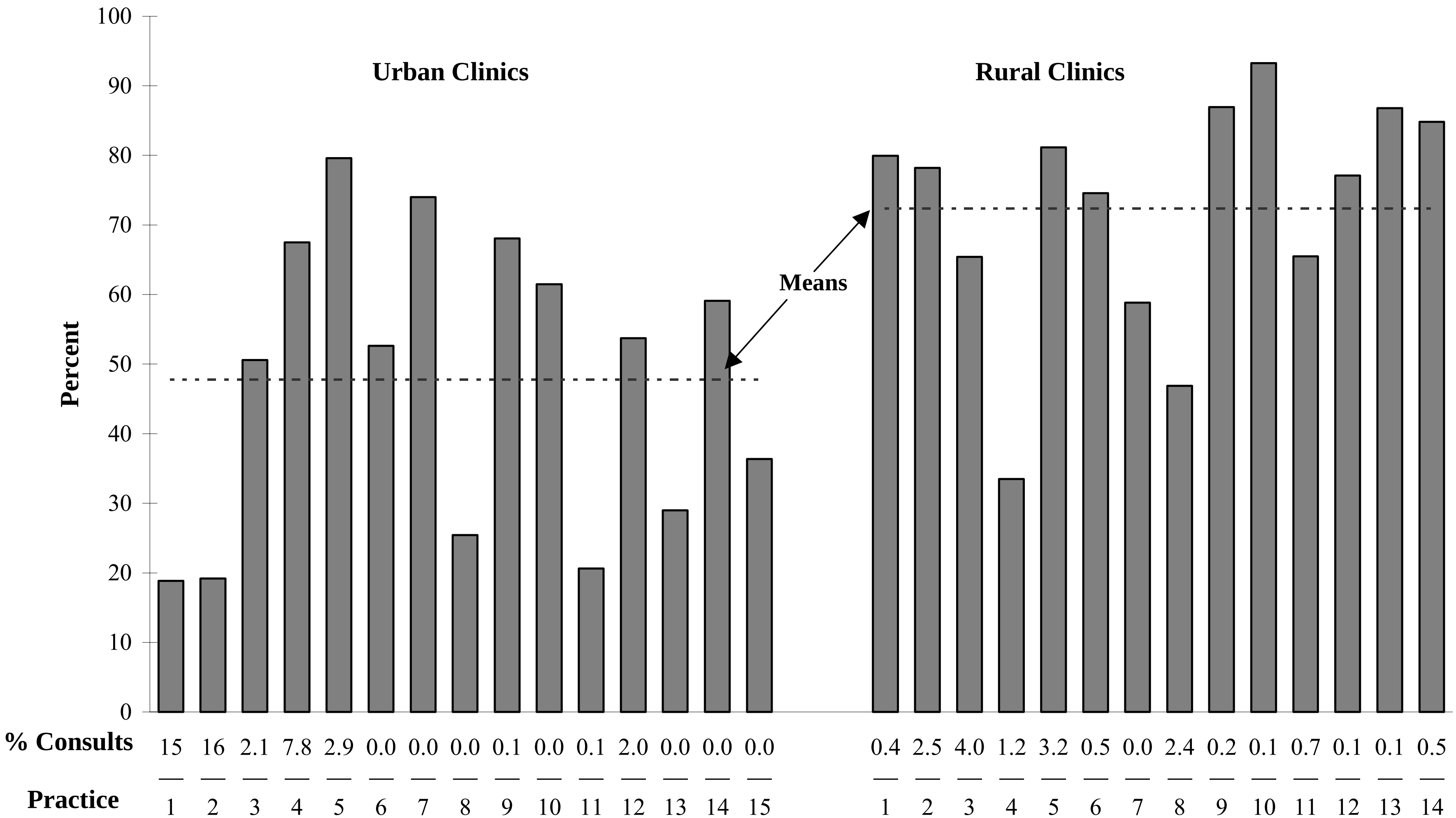
Note: Assignments made using Plurality Approach

Figure 6 shows the degree to which the practice populations are drawn from the geographic area in the immediate vicinity termed the 'dominant' physician service area (PSA). This proportion can be interpreted as the degree to which the practice serves local clientele. Of the 14 rural practices, almost three-quarters of the patient populations (mean: 72%) are residents of surrounding communities, but substantial variation exists. In fact, in practice R8, less than half of the practice comes from the local area[7]. In the 15 urban practices, the proportion of patients coming from the same area was 48% but this too was highly variable (19-80%). In general, the practices with more consultative care showed a wider catchment area than did the others. This is not surprising given that specialists billing consultative services act as 'provincial resources.'

The variation in the extent to which practices cater to local clientele raises some important analytic and policy issues. It may be faulty to presume that an 'area-based' examination of health services need and care patterns will match a 'practice-based' one. In other words, applying a 'population-based' approach to analyzing physician services does not translate into simply examining the characteristics of geographic populations within which physicians are situated. This is especially the case for several large multidisciplinary clinics that provide care to Manitobans from all over the province. To fully appreciate differences in practices' care patterns, one has to build the practice populations 'from the bottom up'. It also follows that because some practices are ill defined geographically, it is difficult to apply a policy that affects physician care (e.g., payment policy) at the local level. For instance, if capitation-based funding for physician services were to be applied in some geographic areas but not others (assuming that a major goal would be to preserve physician-patient relationships), this would mean that some practices would have a portion of their patients paid for by capitation and a portion by traditional fee-for-service. Not only would this be difficult for practices to administer, but it may also reduce the likelihood that the desired goals of such a policy would be achieved.

[7] Rural practice 4 is atypical along a number of dimensions and hence we are not commenting on its characteristics here.

Figure 6: Percent of Practice Population from Dominant Physician Service Area



Note: Assignments made using Plurality Approach

2.3 Morbidity Characteristics of Manitoba's Practices

Since health problems differ in their need for physician and/or hospital services, quantifying the mix of patient illnesses among practice populations is critical in the application of population-based policy instruments such as prospective payments and practice profiling. As discussed above, measurement of population health needs remains a major challenge for researchers and health care policy makers, and nowhere is this more challenging than for research in the ambulatory setting.

For the remainder of the report, we attempt to apply the Adjusted Clinical Groups (ACGs) system to measure differences in the burden of illness among physician practices. This work extends and blends the approaches taken in two recent studies from the Manitoba Centre for Health Policy and Evaluation. In the first study, Reid et al. (1999) examined the validity of the ACG system in Manitoba and tested an 'ACG morbidity index' as a needs-indicator for Manitoba's small geographic areas. In the second, Menec et al. identified large physician practices using administrative data (these are the same practices we describe in this report) and examined issues around defining practice populations (Menec et al. 2000). Menec's report also characterized the health status of 'regular' and 'irregular' patients to these practices using a 4-point ACG-based ordinal morbidity 'score'. In this study, we adapt the morbidity index developed in the first study (a continuous variable) to profile the illness levels of the practices identified in the second. Before discussing the application of the morbidity index to practices, the following section provides a brief review of the ACG system and how the Physician Service Area (PSA)-level morbidity index was created and validated. For more information, readers are referred to these earlier reports (Menec et al. 2000; Reid et al. 1999).

To measure an individual's projected need for and use of health services over time, the ACGs arrange the medical diagnoses collected on administrative health records into an overall measure of 'illness burden'. The overall intent of the ACGs is to estimate an individual's health status in relation to health service need, based on age, sex, and the constellation of diagnoses assigned to patients over a defined time interval, typically one year. Each diagnosis is assigned to one of 32 clinically cogent morbidity clusters, called Ambulatory

Diagnosis Groups (ADGs), which are then grouped, together with the individual's age and sex, so that patients are assigned one of approximately 90 ACGs (Johns Hopkins University School of Hygiene and Public Health 2000). ACGs aim to measure morbidity for individuals, which then can be aggregated to populations. While age and sex adjustment may be reasonable for large populations (because differences in morbidity levels tend to average out), a more sensitive method for case-mix adjustment is needed when examining smaller groups (such as physician practices) or in situations where adverse selection may operate. In addition to its application in health services research (Briggs et al. 1995; Starfield et al. 1994; Weiner et al. 1996a), the ACG system has had broad application in U.S. health care management including adjusting prospective payment rates (Fowles et al. 1996; Weiner et al. 1996b; Weiner et al. 1998) and profiling provider efficiency (Green, Barlow, and Newman 1997 ;Parente et al. 1996; Salem-Schatz et al. 1994; Tucker et al. 1996). In fact, the ACGs are now considered the gold standard in US provider profiling tools. In British Columbia and Manitoba, we found performance of the ACGs to be similar to the U.S. experience. ACGs were able to explain about 50% and 25% of the variation in same year and next year physician costs and about 40% and 14% of same year and next year 'total' (physician and hospital) costs. ACGs are currently being used in British Columbia to adjust provider payment rates in the Primary Care Demonstration Project (PCDP) (B.C.Ministry of Health and Ministry Responsible for Seniors 2000) and in the development of physicians' economic 'profiles' to identify aberrant billing patterns (British Columbia Medical Services Plan 2000).

ACGs offer several advantages in the measurement of morbidity at the practice level. First, diagnoses are logically grouped into morbidity categories based on several clinical attributes (e.g., recurrence or persistence of the condition over time) and on the expectations future services will be required. Therefore, in as much as they accomplish this goal, the ACGs describe the health service 'needs' across the full spectrum of health problems that physicians see in their offices and in health care institutions. Furthermore, the morbidity categories reflect the mix of conditions that patients face and thus are appropriate for case-mix adjusting patient-based capitation payments or practice profiles. Second, ACGs were conceptualized to measure case mix in the ambulatory care setting (and only later extended to institutional care) and thus are useful in capturing the care provided in ambulatory practices.

Third, ACGs aim for clinical relevancy, a key attribute when developing indicators that are sensitive to how physicians care for their patients. ACGs address differences among diagnoses in the expected duration of illness, severity, diagnostic certainty, etiology, and expected need for specialist care and hospitalization. Finally, as opposed to other measures of population need (such as premature mortality), ACGs can potentially be used to assess morbidity and health service need for relatively small populations over short intervals. This requirement is essential when policy makers consider applying capitation funding or quality assurance mechanisms for practices which are relatively small and which undergo continuous evolution (in patient and physician populations).

The principal drawback of the system is that it relies on ambulatory diagnosis data of uneven quality. Moreover, although the ACG system is not a utilization-based system per se, the system may under- or over-estimate morbidity for patients with lower or higher than average contact rates with physicians and/or hospitals. For instance, where groups tend to under-use physicians relative to their morbidity levels (i.e., those with lower socioeconomic status) their morbidity levels may be underestimated due to the fact that they do not obtain the full spectrum of diagnoses that characterize their morbidity level. A more detailed description of the ACG system is available elsewhere (Johns Hopkins School of Public Health 2000).

2.3.1 Applying the ACG Morbidity Indices to Physicians' Practices

To create the practice-based index that quantifies differences in morbidity levels, we used the ACG morbidity index, developed and tested in our earlier report to measure population morbidity for small geographic areas(Reid et al. 1999), and applied it to measure the illness levels and health service needs in Manitoba's large physician practices. In this previous study, we created illness weights for the ACGs using average provincial health care costs, and then averaged the ACG-specific weights across the geographically defined populations for Manitoba's 59 physician service areas. In this study, we again assigned ACGs to all Manitoba residents (i.e., each person was given one of 82 categorical ACGs based on their diagnoses) and costs were averaged over the whole population to create the ACG specific illness weights based on the assumption that overall costs are responsive to differences in morbidity levels. Two cost variables were used: physician costs and total (physician and hospital costs (see below).[8] Next, the average (or *expected*) costs were assigned to the practices' patients (using the plurality and equivalent assignment methods) and averaged across the practice populations. Lastly, the practice-based ACG morbidity index was created by dividing these averages by the provincial grand mean. The main issues in applying the ACG index at the practice level were to: 1) identify the practice populations and 2) define what costs to include in the 'expected' costs. As described above, we elected to use both the plurality and equivalent definitions and create illness weights using both 'physician' and 'total' costs. (See below for a discussion of the relative merits of using these different types of costs.)

To validate these indices, we compared their performance against other available practice parameters, including the proportion of consultative vs. non-consultative visits (used to measure the degree that specialist referral care was delivered at the clinics) and the patients' demographic mix (including age, sex, and neighborhood income quintile). We had the a priori expectation that practices with *older* populations and those with patients in *lower* socioeconomic strata should have *greater* health care needs (i.e., higher levels of morbidity) and thus we should obtain *higher* ACG indexes. We also examined the variability of the indices across practices.

It is important to recall that, in our first report, we found the ACG morbidity index relatively unstable for small PSAs (fewer than 2000 residents) (Reid et al. 1999). This is not a significant problem in applying the index to our large study practices (four or more general/family practitioner FTEs). However, this issue gains importance if one intended to apply the index to smaller practices, often composed of only one or two physicians. For physicians submitting electronic fee-for-service billings to Manitoba health (or shadow claims for salaried physicians), general/family physicians working within the 29 relatively

[8] In addition to applying ACGs to analyze need for overall services, they can also be specified to reflect need for specific types of services including GP services, specialized services, diagnostic testing, surgery, hospital care and others. To comprehensively differentiate between these types of need among physician practices, additional ways of weighting the ACGs should be used.

large groups included in this report[9] accounted for less than 45% of all general/family physicians (FTEs) (Menec et al. 2000). The use of ACGs to profile the morbidity of small practices is not analyzed in this report. In the U.S. however, ACGs are used to quantify morbidity in populations as small as 400 patients (C.B. Forrest, personal communication).

By way of example, Table 4 shows how we applied the ACG morbidity index to our hypothetical practice of five patients (after making the plurality and equivalent patient assignments). The ACG-specific expected costs (Row H) were obtained by averaging the provincial costs (physician or total) within each ACG and assigning them to the patients in the practice with those ACGs. With the plurality assignment approach, the totality of the expected costs for the assigned patients was allocated to the practice. The morbidity index was calculated by averaging the expected costs across the plurality patients and dividing by the provincial grand mean. In contrast, when we applied the equivalent assignment approach, we allocated the ACG expected costs to practices in proportion to how the actual costs were distributed. For instance, if a patient's ACG expected costs were $66 (ACG 600:likely to recur conditions with allergies) and they obtained one third of their care from three clinics (i.e., a single office visit to each clinic), then each clinic would be assigned an expected cost of $22. The index was then calculated by dividing the total expected costs over the number of equivalent patients and then dividing by the overall provincial average. Because the equivalent approach leads to 'synthetic' practices, the ACG morbidity index can be viewed as the sum of the 'portions' of each patient's morbidity seen at the practice. For instance, if a practice has three patients who each obtained one third of his or her care at that practice, we assume this to be equivalent to one patient with a morbidity burden equal to the average of the three patients. As mentioned above, the main disadvantage of this approach is that a patient's illness level is split according to actual costs, potentially 'rewarding' a practice for an inefficient practice style.

[9] Practice group could not be determined for the 270 physicians submitting paper claims, so there may in fact be more groups meeting the four FTE criteria than we have identified hospital care and others. To comprehensively differentiate between these types of need among physician practices, additional ways of weighting the ACGs should be used.

Table 4: Calculating the ACG Morbidity Index for a Hypothetical Practice with Five Patients

Patient Characteristic			**Patient I**	**Patient II**	**Patient III**	**Patient IV**	**Patient V**	**Clinic Total**
Age (y)			45	26	5	63	34	-
Sex			M	F	M	M	F	-
Residential Physician Service Area (PSA)			K1	K1	K1	C	T	-
Ambulatory Care Group (ACG)			900	1600	200	4420	3400	-
Actual Costs ($)	Total	(A)	160	30	100	300	100	-
	Clinic A	(B)	128	30	40	120	20	-
	Oth Clinic B	(C)	0	0	60	100	0	-
	Oth Clinic C	(D)	32	0	0	80	80	-
Patient Assignment (Clinic A)	**Discrete**	**(E)**	1	1	1	1	1	5
	Plurality	(F)	1	1	0	1	0	3
	Equivalent	(G)=(B/A)	0.8	1	0.4	0.4	0.2	2.8
ACG Expected Costs ($) for Clinic A	Total	(H)	90	50	70	450	190	-
	Plurality	(I)=(HxF)	90	50	0	450	0	**590**
	Equivalent	(J)=(HxG)	72	50	28	180	38	**368**

ACG Morbidity Index (Clinic A) = Avg. ACG Expected Costs / Avg. Provincial Cost

Plurality Approach: = (590 / 5) 259 = 0.46

Equivalent Approach: = (368 / 3) 259 = 0.47

As discussed above, we chose to create weightings for the ACGs to reflect overall morbidity levels and need for health care based on the average costs of 'physician' and 'total' (physician and hospital) care (truncated for high-cost outliers). We believe the use of cost data is reasonable given that ACGs were designed to measure morbidity in reference to the need for current and future health care resources. In other words, the main objective of ACG development was to specify the features of specific morbidities (i.e., duration of illness, severity, diagnostic certainty, etiology, and expected need for referral) that would have significant implications for future resource use. Obviously, the choice of which weights to use - physician only vs. physician and hospital – depends on which types of medical care needs one is attempting to specify. For patients with ACGs with many different conditions, some of which are severe, it would be expected that many of the required services would occur in the hospital environment at relatively high expense. Thus, it would be expected that the needs for physician and hospital resources would greatly exceed their needs for physician resources only. Conversely, for low intensity ACGs, we would expect that overall needs are small and most would occur within the primary care practice setting. Thus, it is expected that populations with a larger share of very ill patients would appear as having higher health needs when the ACG indices are constructed with 'total' vs. 'physician' cost weights.

For our approach of weighting ACGs using cost data to work, that is to accurately describe differential health needs across physician practices, we must assume that, on the whole, expenditures are responsive to differences in health needs. In other words, the system has vertical equity and delivers proportionately more services – physician and hospital – to persons with greater needs. Evidence supports this notion regarding the delivery of hospital services in Manitoba. Roos and Mustard (1997) found that health status (measured by life expectancy and mortality rates) varied strongly by neighborhood income levels, as did the likelihood of hospitalization: the poorer the neighborhood, the lower the health status and the higher the hospitalization rate. However, the researchers found a smaller gradient across the income levels relating to the use of physician services with those from low income neighborhoods having a somewhat higher physician contact rate than individuals from high income neighborhoods, a gradient which disappeared when only specialist services were examined. That is, specialists provide no more services to individuals from low income neighborhoods (despite the evidence that such individuals have higher health needs), than to individuals from high income neighborhoods. Thus, while we present the ACGs weighted by physician costs only to reflect the morbidity-related needs for physician services, we recognize that they may overestimate the morbidity-related physician service needs for low intensity ACGs and under-estimate those relating to the high intensity ones. Since hospital services appear to be more responsive to health needs, we anticipate that the ACGs weighted by the combined hospital and physician costs may more closely track differential patient needs across physician practices.

Table 5 presents the total ACG 'expected' costs for the clinic populations, the average ACG 'expected' costs (total ACG expected costs divided by the practice count), and the final ACG morbidity indices for our set of large Manitoba practices. These summary measures are presented for both assignment methods and both types of costs.

Using the plurality assignments and physician cost weights, the index shows substantial variation, ranging from 0.76 (interpreted as serving a group of patients which is 24% *healthier* than the Manitoba average) to 1.41 (interpreted as serving patients 41% *sicker* than the Manitoba average). Therefore, the ACG morbidity index suggests that 'health needs' vary approximately 65% across the patient populations served by large Manitoba clinics. When the equivalent assignments are used, the range in the indices is slightly narrower (0.78-1.33) but the difference in means is not statistically significant (p=0.25).

Table 5: ACG Morbidity Indices for Study Practices, 1995/96

		Plurality Approach*						Equivalent Approach*					
		Total ACG Expected Costs (x$1,000)		Average ACG Expected Costs ($)		ACG Morbidity Index**		Total ACG Expected Costs (x$1,000)		Avg ACG Expected Costs ($)		ACG Morbidity Index **	
		Physician	Total	Physician	Total	Physician	Total	Physician	Total	Physician	Total	Physician	Total
Urban Clinics	U1	17,670	50,546	366.07	1,089.46	1.41	1.38	13,716	44,249	344.68	1,098.34	1.33	1.39
	U2	15,872	43,974	319.82	880.96	1.23	1.11	12,540	39,948	310.10	904.79	1.20	1.14
	U3	5,828	16,365	302.12	857.64	1.17	1.09	5,637	16,034	279.72	793.76	1.08	1.00
	U4	8,063	22,892	304.28	877.70	1.17	1.11	6,689	20,728	293.72	892.41	1.13	1.13
	U5	3,437	9,572	289.03	804.80	1.12	1.02	2,803	8,587	272.08	804.55	1.05	1.02
	U6	1,415	3,606	229.13	578.56	0.88	0.73	1,387	3,460	219.23	546.61	0.85	0.69
	U7	1,977	4,632	246.61	586.83	0.95	0.74	1,756	4,231	235.11	570.41	0.91	0.72
	U8	1,655	5,291	294.28	934.03	1.14	1.18	1,562	5,030	283.23	909.39	1.09	1.15
	U9	1,184	2,134	221.98	408.34	0.86	0.52	1,147	2,116	218.26	411.38	0.84	0.52
	U10	2,217	5,066	275.79	700.41	1.06	0.89	1,789	4,560	259.81	671.81	1.00	0.85
	U11	982	1,875	239.85	465.82	0.93	0.59	1,017	1,974	232.74	462.28	0.90	0.58
	U12	1,369	3,504	204.48	519.88	0.79	0.66	1,124	3,005	202.15	534.13	0.78	0.68
	U13	591	993	206.46	354.12	0.80	0.45	642	1,118	210.18	374.42	0.81	0.47
	U14	535	849	197.17	317.81	0.76	0.40	601	987	201.08	337.56	0.78	0.43
	U15	738	1,351	224.95	426.32	0.87	0.54	662	1,272	225.99	448.05	0.87	0.57
Rural Clinics	R1	4,436	13,486	275.96	836.34	1.06	1.06	3,883	12,464	261.72	821.23	1.01	1.04
	R2	3,273	8,544	259.23	678.24	1.00	0.86	2,811	7,849	245.28	668.20	0.95	0.85
	R3	3,184	9,166	302.54	895.55	1.17	1.13	2,735	8,515	290.20	896.89	1.12	1.13
	R4	1,536	3,424	228.56	522.23	0.88	0.66	1,430	3,283	219.91	516.21	0.85	0.65
	R5	2,002	5,608	259.09	732.56	1.00	0.93	1,800	5,246	248.23	716.16	0.96	0.91
	R6	1,559	4,624	238.89	696.37	0.92	0.88	1,390	4,331	226.37	677.05	0.87	0.86
	R7	1,249	3,139	247.97	634.57	0.96	0.80	1,041	2,829	233.86	632.04	0.90	0.80
	R8	955	2,274	281.25	677.27	1.09	0.86	901	2,235	268.08	665.29	1.03	0.84
	R9	1,138	3,462	298.41	908.11	1.15	1.15	984	3,064	282.44	866.31	1.09	1.10
	R10	1,031	3,082	277.55	822.64	1.07	1.04	922	2,905	266.08	813.70	1.03	1.03
	R11	1,080	3,178	292.53	869.13	1.13	1.10	913	2,813	277.31	840.04	1.07	1.06
	R12	1,065	3,043	293.09	841.19	1.13	1.06	925	2,820	280.78	835.69	1.08	1.06
	R13	792	2,248	236.60	669.24	0.91	0.85	721	2,107	228.73	658.62	0.88	0.83
	R14	701	2,007	289.74	825.66	1.12	1.04	579	1,779	271.13	797.77	1.05	1.01

* Plurality refers to assignment based on practice where patient received plurality of costs (‘physician’ or ‘total’ costs). For ‘equivalent’ approach, patients are weighted by proportion of costs attributed to practice.
** Average ACG expected costs divided by average provincial costs ($259 physician costs; $790 total costs).

When ’health need’ is operationalized with the total cost weights, as expected, the variation in medical care need among clinic populations becomes even larger. Using the plurality assignments, the index increases in range from 0.40 to 1.38, roughly a 100% difference in illness levels. This range is only marginally different when equivalent assignments are used (0.43 to 1.39). As stated above, the higher variability in the total versus physician cost indices is not unexpected, since most of the care costs for persons with high intensity ACGs stems from in-patient care (whereas low intensity ACGs generally consist of physician costs only). In relative terms, clinics that appear to serve a relatively ‘healthy’ group of patients in relation to their need for physician services (i.e., composed of fewer persons with resource intense ACGs) appear even ‘healthier’ when their patients are profiled with respect to their need for physician *and* hospital services. The practical implication of this finding is that the use of different types of costs to weight ACGs can have a significant impact on estimating the relative morbidity of physician practices.

When the indices in the urban vs. rural clinics are compared (Figure 7), the rural clinics appear to have more similar morbidity levels compared with the urban ones. (For the physician cost indices, the standard deviations are 0.19 vs. 0.09 for the urban and rural clinics respectively; for the total cost indices, the standard deviations increase to 0.31 and 0.14). Several factors may explain the larger variation found across the urban clinics. First, we expect that urban clinics that deliver consultative services by specialists to have at least a group of their patients who are much sicker, since they are likely referred complicated patients from other practices. Second, the increased availability of urban primary care physicians may create more opportunity for physicians to ‘concentrate’ their practices with certain types of patients or provide only certain types of care. For example, primary care physicians in urban areas may focus their practices in obstetrics, sports medicine, or psychiatric care and thus their practices would largely reflect patients with similar morbidities (which may or may not be sicker than other patients). Such opportunities are more rare in rural practices because of the limited availability of physicians. This hypothesis is consistent with a recent study of B.C. general/family practitioners, which found that rural physicians perform a wider range of services and see greater arrays of patients than their urban colleagues (Kazanjian et al. 2000). Finally, the indices may be systematically biased downwards for relatively ill individuals in areas where there are relatively few physicians and/or for practices treating individuals with lower socioeconomic status who tend to visit physicians less that expected given their health status. (Recall that in Table 3 we found much greater diversity in the socioeconomic mix of patients across the rural clinics than across the urban clinics.)

2.3.2 Performance of the ACG Morbidity Indices for Individual Clinics

Figures 8 to 12 examine the ACG morbidity indices for the individual clinics in more depth, comparing the different assignment and weighting techniques. As in the previous graphs, the clinics are ordered as in Figure 1, by decreasing numbers of discrete patients contacting the clinic during the year. The mean age of the clinic populations (plurality assignment) and GP/specialty mix is also presented. The aims of these analyses are twofold. First, by comparing the indices against the physicians' specialty mix, and the patients' ages and income levels, we can examine whether the indices are performing in ways that we would expect. We have the a priori expectation that the ACG morbidity indices should generally be *higher* in clinics with a *lower* proportion of GPs, *higher* mean age, and with patients with *lower* mean income levels.

Figure 8 shows the relative morbidity levels for the individual clinics (with the plurality and equivalent populations) when weighted by physician costs only. In general, the indices appear to vary in the hypothesized ways suggesting considerable concurrent validity. The clinics with the highest indices (i.e., the *sickest*) are all those with a sizable proportion of consultative visits (U1, U2, U4). This is to be expected if we assume that patients who are referred to specialty care are generally more ill than those who are not. It may be also be the case that, for any given severity of illness, specialists tend to use different codes than do generalist physicians making it appear that they have sicker practices as a result. A practice with specialists may therefore appear to have sicker patients than GP only clinics even if their true morbidity burden is the same. In the clinics without specialty care, the data reveal that the clinics with the oldest patients are generally also the more ill – again an expected finding since age is highly related to illness burden.

Figure 7: Distribution of ACG Morbidity Index for Urban and Rural Clinics, by Patient Assignment and ACG Weighting Methods

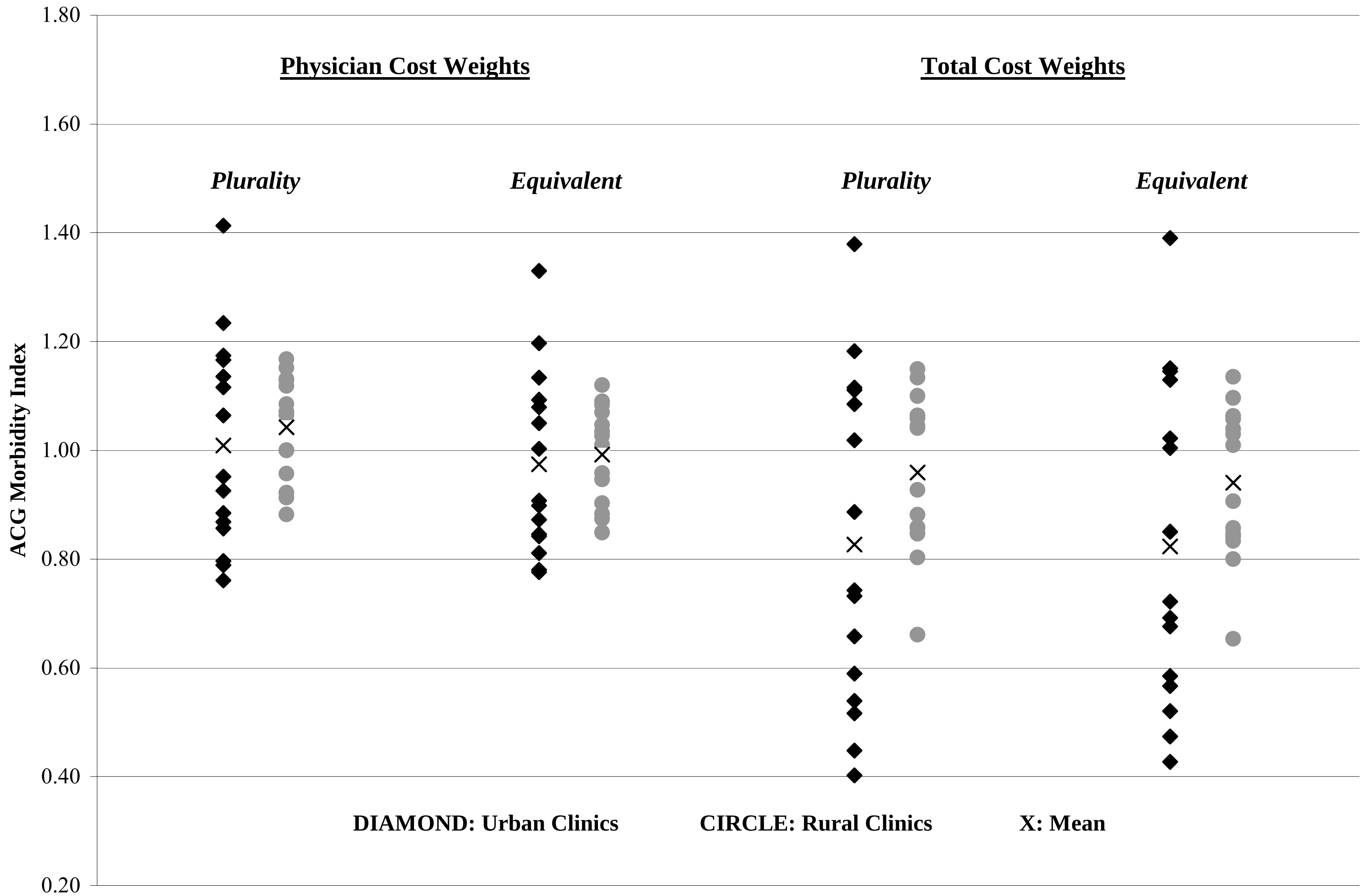


Figure 8: Comparison of ACG Morbidity Indices (Plurality & Equivalent), Mean Age & Percent Consults (*indices constructed with physician costs*)

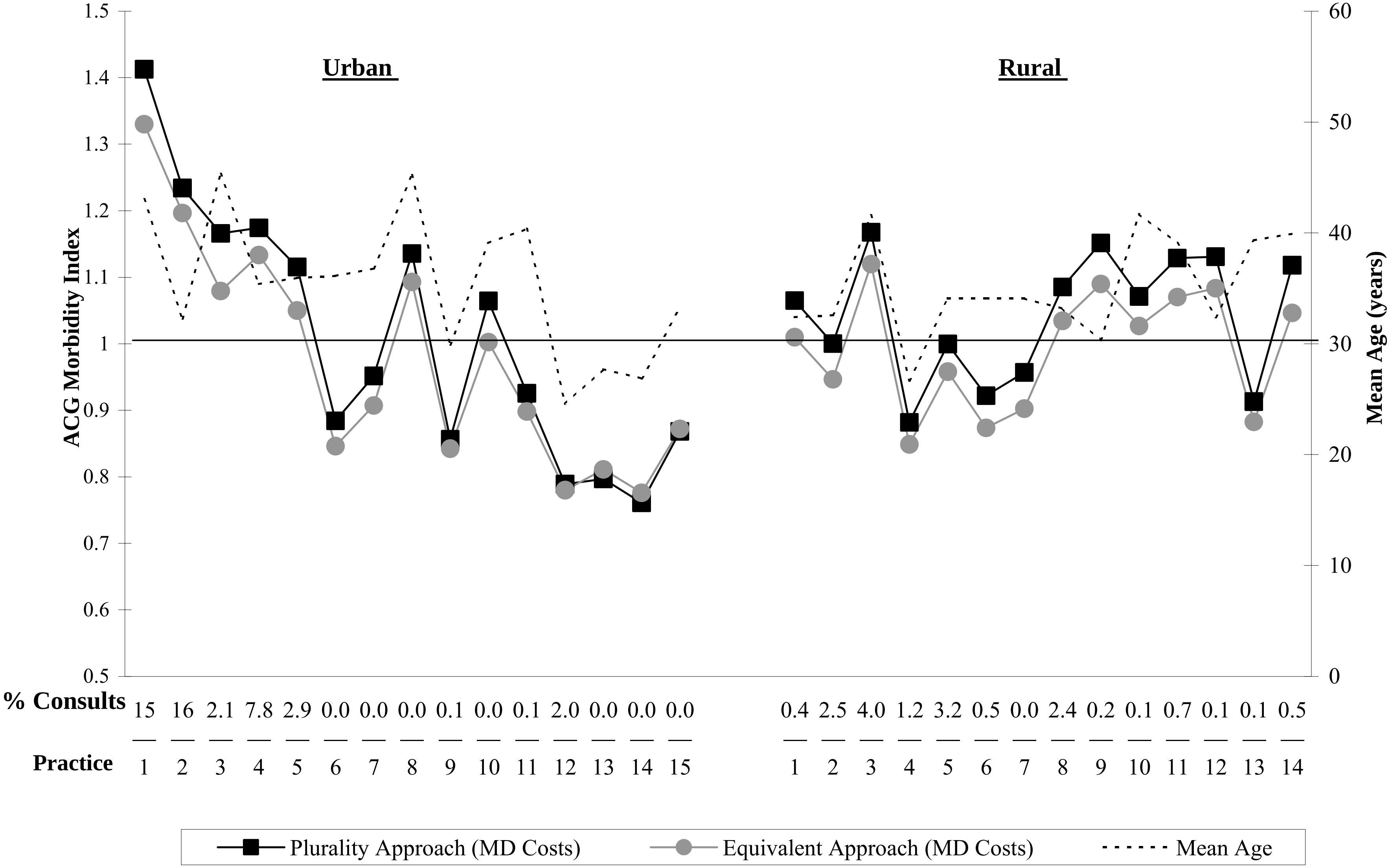


Figure 9 plots the mean age and the morbidity index revealing a moderately strong linear relationship (Pearson coefficient = 0.67). (We do not expect a perfect relationship with age because the illness burdens of patients [and populations] are related to a complex array of factors including age (Iezzoni 1994). However, while the morbidity indices appear to perform as expected for most clinics, there are some notable rural exceptions. Specifically, for clinic R13, the ACG index suggests that the patient population is 9% *healthier* than the Manitoba average (0.91) but the average age is for this population is 39.3 years which is 3.2 years higher than the provincial mean, implying that the population should be substantially *sicker* than average. Similarly, the mean age of the patient population in clinic R10 is 41.7 years (the highest among the rural clinics and 15.5% above the provincial mean) but the indices constructed with physician costs suggest that the population is only 7% sicker than the provincial average. Unless the elderly in these practices are particularly healthy (unlikely given that they come from relatively poor neighborhoods, these findings raise the prospect that the ACG index may *under-represent* the true morbidity burdens of some practices. This possible bias may be caused by particularly poor diagnosis coding at these clinics and/or less overall physician contact by these populations (and fewer opportunities to obtain appropriate diagnoses). Other possibilities for this finding may relate to favorable selection or random error. In contrast to these clinics, other clinic populations (R8 and R9) appear to have *higher* indices than would be expected based on their age characteristics. However, these findings are plausible given that there is more patient representation at the lower income levels.

In general, the plurality assignments produce slightly higher ACG indices for most clinics than do the equivalent assignments. This effect is most apparent for the 'sickest' clinics, and probably relates to the fact that some relatively ill persons in these clinics obtained a significant amount of care (but not the plurality) at other sites. However, the changes are relatively small since there was virtually no change in relative rankings (Spearman coefficient r=0.99). (Figure 10 presents similar data except using total costs to weight the ACGs. These weights produce very similar results for the equivalent and plurality assignments in almost all clinics.)

Figure 9: Scatterplot of ACG Morbidity Index and Mean Age of Practice Populations

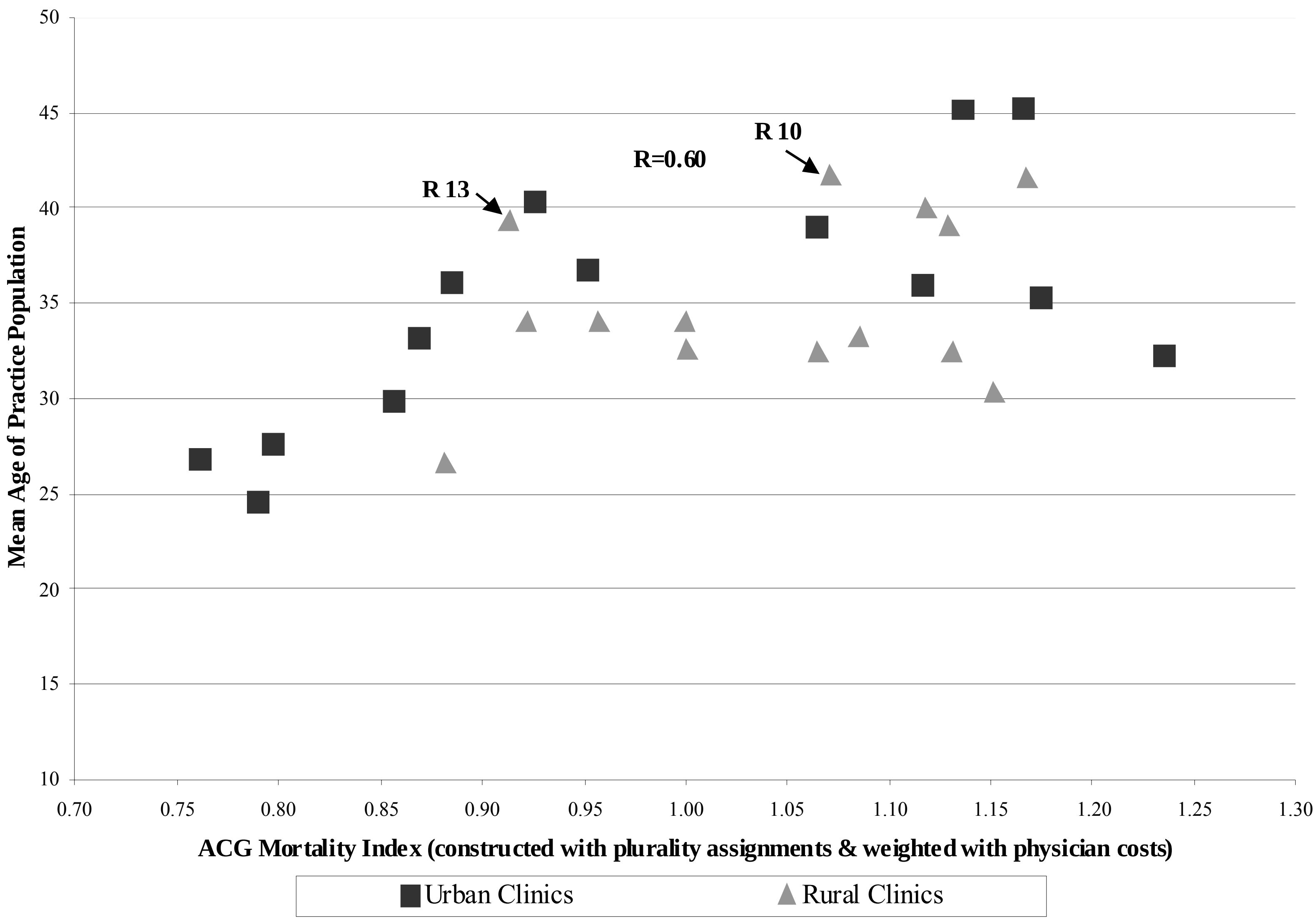


Figure 10: Comparison of ACG Morbidity Indicies (Plurality & Equivalent), Mean Age & Percent Consults (*indices constructed with total cost weights*)

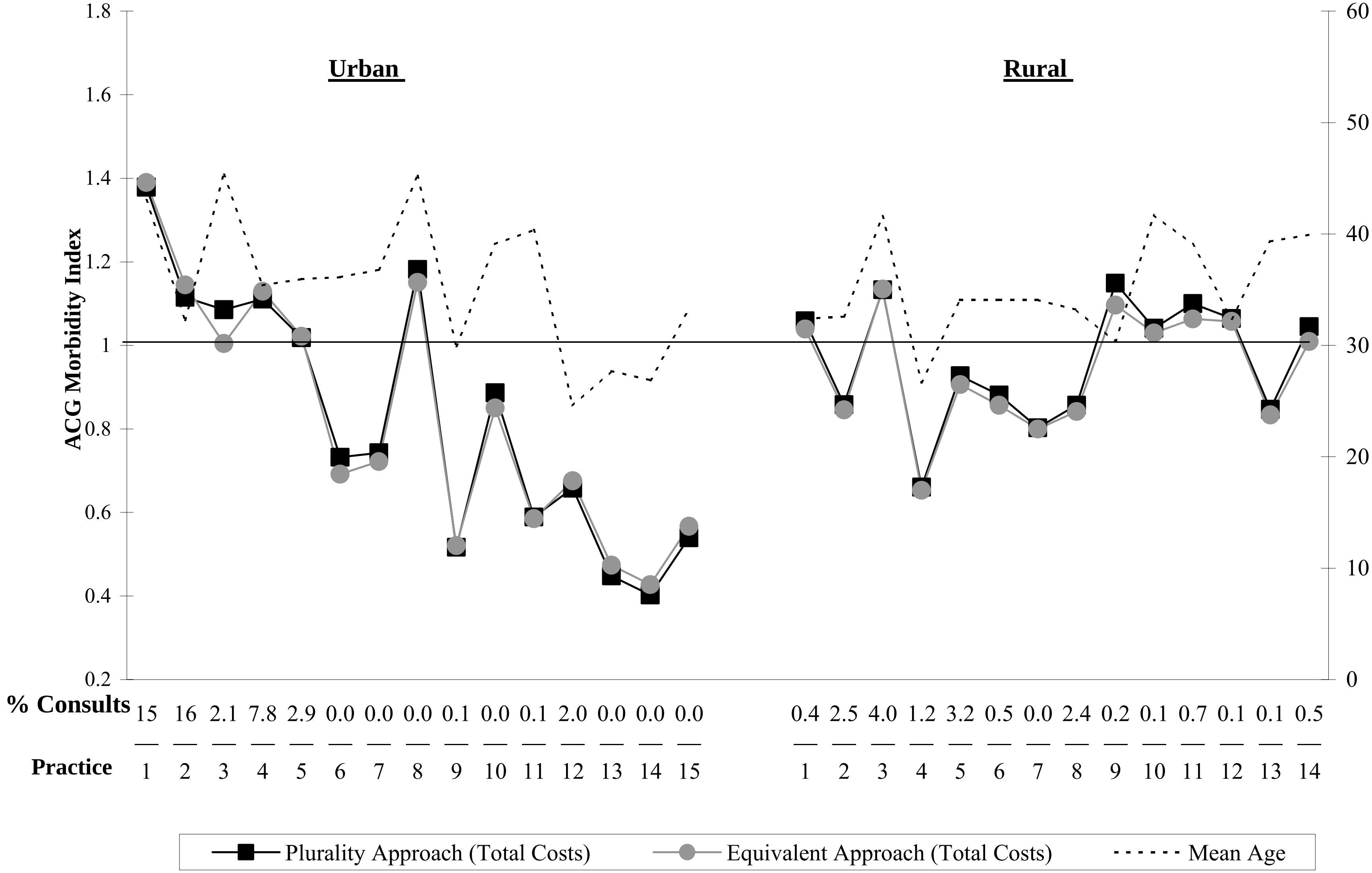


Figure 11 compares how the morbidity indices change with our different approaches to weighting. While the relative ranking of the clinics is very similar between the weighting schemes (Spearman's correlation coefficient r=0.94), the differences between the indexes are larger for some clinics (and in a different direction) than others. In general, the clinics that appear relatively 'healthy' with respect to their 'need' for physician services (i.e., index less than one) appear even 'healthier' with respect to their need for physician and hospital services combined. For several clinics (U9, U11, U13, U14, U15), this effect is quite marked with these clinics appearing 30-35% 'healthier' relative when total costs were used. The choice of weights also appears to affect the urban clinics more than the rural ones. The mean difference (i.e., the physician cost index minus the total cost index) among urban clinics (-0.09) was almost twice that for rural clinics (-0.18) (p>0.001).[10] These findings were consistent when equivalent assignments were used (Figure 12).

In summary, the above results show that morbidity is not randomly distributed across Manitoba practices. The patients served by some practices appear significantly healthier than the Manitoba population overall and some significantly sicker. Moreover, the differences appear quite marked, regardless of whether the ACGs are weighted to reflect 'need' for physician services only or 'need' for physician and hospital services combined. These differences in morbidity burden are critical in understanding the patterns of care delivery among practices. Without consideration (or inadequate consideration) of these differences in applying population-based funding or quality improvement programs, such initiatives could inappropriately direct resources away from the least healthy populations and/or penalize the providers that care for them.

[10] Because all patients in the province are assigned (and none are duplicated) using the plurality approach, this finding also suggests that there may be differential effects according to the weighting scheme chosen in smaller clinics not represented in our sample.

Figure 11: Comparison of ACG Morbidity Indices (with Physician & Total Costs), Mean Age & Percent Consults *(indices constructed with plurality assignments)*

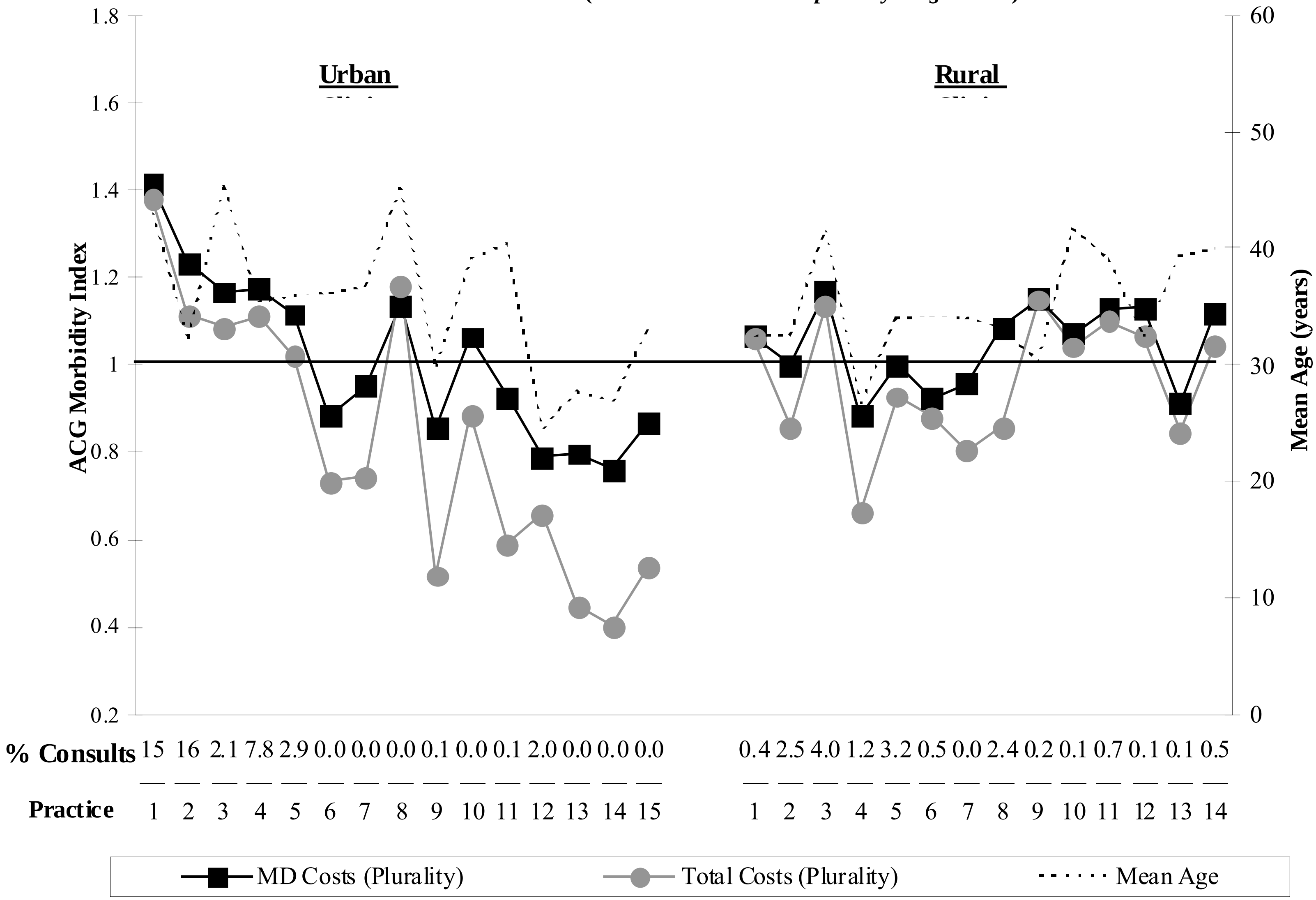
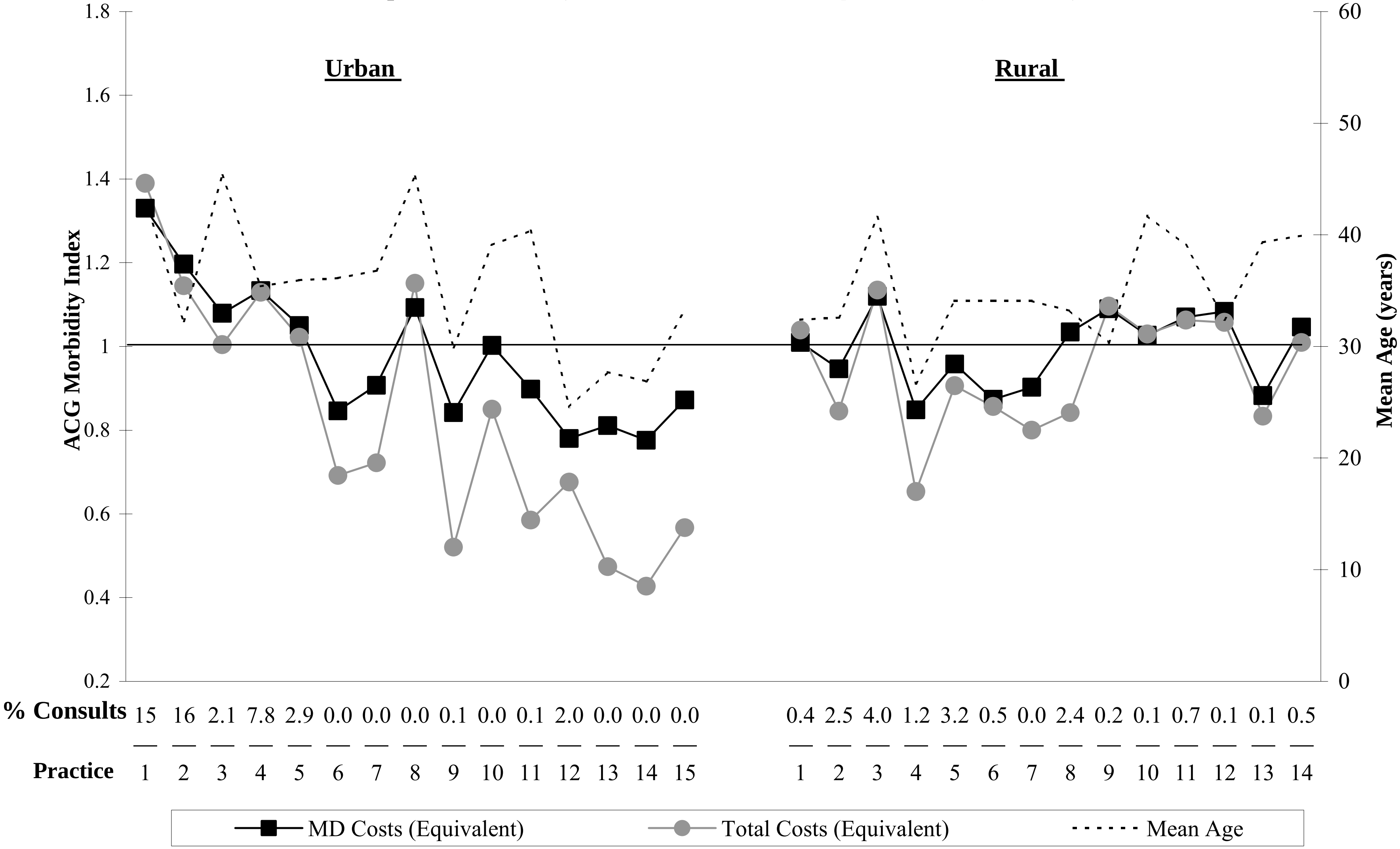


Figure 12: Comparison of ACG Morbidity Indicies (with Physician & Total Costs), Mean Age & Proportion of GPs (*indices constructed with equivalent assignments*)



On the whole the ACG indices appear to perform the way they are expected, providing us with evidence that they can be applied at the practice level. However, for some clinics, they appear to not perform well, indicating that the clinic populations are healthier than what we would expect. This finding raises the prospect that the ACG index may be biased upward for some clinics, perhaps because of physician (or hospital coding) behavior or because of difficulties that patients who use certain clinics have in accessing services. It is certainly plausible that certain physicians (and their practices) pay less attention than do others to the accuracy of their diagnosis codes since the codes currently carry no practical significance and do not affect how physicians are compensated. If these diagnosis data were to be used for payment or profiling purposes (and especially if the bias is in the *under-representation* of morbidity), there would be an incentive for these clinics to *improve* the accuracy of this coding which would in turn improve the accuracy of the practices' indices. However, the incentives for 'upcoding' are universal across all clinics in the real-life application of diagnosis-based case-mix systems for payment or profiling purposes. Thus, the ACGs morbidity indices are susceptible to 'gaming' that could result in biased estimates if upcoding occurs differentially among clinics. Studies on the application of Diagnosis Related Groups (DRGS) to prospectively pay U.S. hospitals, suggest that substantial 'diagnosis creep' did occur (Carter, Newhouse, and Relles 1990). While the ACG developers have incorporated strategies to decrease the susceptibility of the ACGs to strategic manipulation, there is little conclusive evidence to gauge how effective they are. Thus, if applied in applications of provider profiling or capitation adjustment in Manitoba based on current data, it is likely that health care administrators would require additional risk adjustment strategies such as the use of socioeconomic status or premature mortality rates at least in the short term.

2.4 Adjusting the ACG Morbidity Index

Our previous research showed that the ACG morbidity index was closely related to an area's premature mortality when both were applied to geographic populations (Reid et al. 1999). Premature mortality is considered the 'gold standard' for measuring population health need for a general range of services (Carstairs 1995; Hutchison et al. 2000; US General Accounting Office 1996). The ACG index was more closely related to the premature mortality rate than were mean expenditures or a similarly constructed index based on average costs for age and sex groups. The advantages of the ACG morbidity index in measuring need compared with premature mortality is its potential application over relatively short intervals (one year) and its ability to specify different types of health need (such as need relating to infants or pregnancy). However, the index's major limitation is that it appears to be systematically related to physician visit rates. Although the ACGs are not a utilization-based case-mix tool per se, higher visit rates make the coding of appropriate morbidities more likely. This is particularly problematic when comparing rural and urban areas, which have markedly different health service supply and use characteristics (Black, Roos and Burchill 1995; Tataryn, Roos and Black 1995). As such, we found that relative to premature mortality rates, the ACG morbidity index tended to systematically inflate the needs estimates for urban areas relative to rural ones. A main goal in our application of the ACG morbidity index to practice populations is to fairly compare morbidity across practices, regardless of the community in which they are situated or of the populations they serve. We sought to apply a methodology that would 'adjust' the ACG index to better reflect comparable need across the province

Our adjustment approach used the premature mortality rate (PMR), measured at the level of the physician service area (PSA), to 'correct' the ACG-measured need of persons residing in those PSAs. In other words, we adjusted the 'need' of individual patients measured with the ACGs using an ecological variable (which we term the PMR-based 'correction factor') relating to the PSAs in which they reside. We used the PSA as the ecological unit of analysis because it was the smallest reference unit with stable mortality rates. Since we applied the PMR-adjustment at the level of the PSA, we make the implicit assumption that the 'contact' bias is equivalent across individuals residing in those areas.

Our adjustment of the practice-based ACG index with PSA-level PMR involved two main tasks: (1) creating the 'correction factor' for the morbidity index at the level of the PSA; and

(2) applying this factor to the ACG 'expected' costs at the patient-level and aggregating these costs to form a practice-based ACG index.[11] These steps are briefly described below.

Adjusting the Morbidity Index for Manitoba's Physician Service Areas (PSAs)

Calculation of the PSA-level 'correction factor' was based on the three-step approach of Frohlich and Carriere.(Frohlich and Carriere 1997) who used multiple linear regression techniques to measure relative 'need' for generalist physicians among Manitoba's health regions. The first step involved calculating an ACG index for each PSA as described elsewhere.(Reid et al. 1999) The second step involved linearly regressing the ACG index on the premature mortality rate. The third step involved using the beta coefficient obtained from the regression model to a calculate PSA-specific 'correction factor' using the following equation:

$$\text{ACG MI Correction Factor}_{\text{PSA}} = \frac{\text{ACG MI}_{\text{PSA}} + \beta\,(\text{PMR}_{\text{PSA}} - \text{PMR}_{\text{Province}})}{\text{ACG MI}_{\text{PSA}}}$$

Figure 13 outlines the complete process involved in constructing and adjusting the PSA-level ACG morbidity index. Figures 14 and 15 show the premature mortality rates and the ACG indices (adjusted and unadjusted) for the 60 PSAs (constructed with physician and total costs respectively) in order of descending premature mortality rates. (The areas where the study practices are located are marked with an asterisk.)

[11] Since the practice populations consist of persons in multiple PSAs we applied the premature-mortality adjustments at the individual rather than the practice level.

Figure 13: Flowchart for Constructing ACG Morbidity Index and Adjusted Index for Physician Service Areas (PSAs)

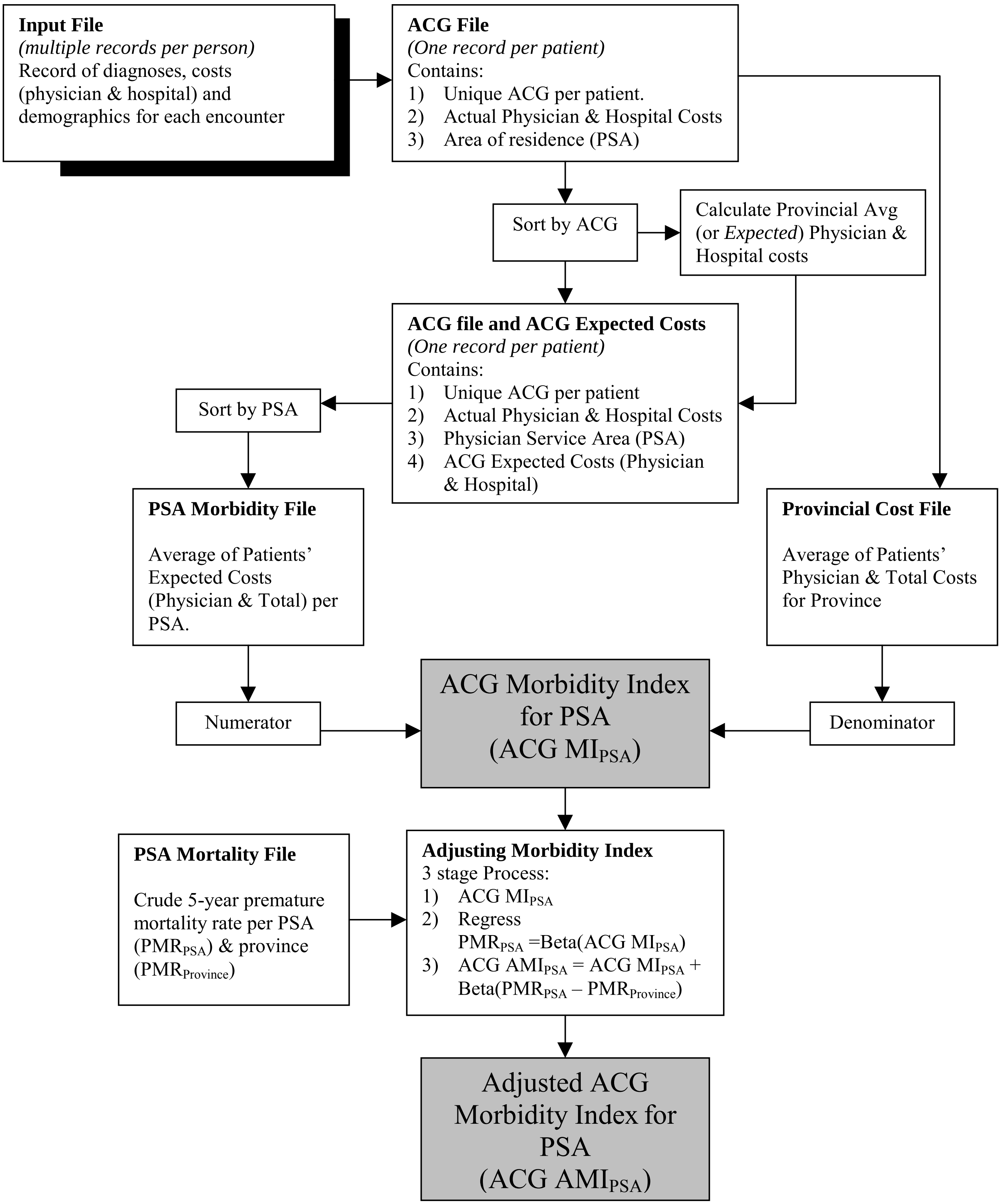
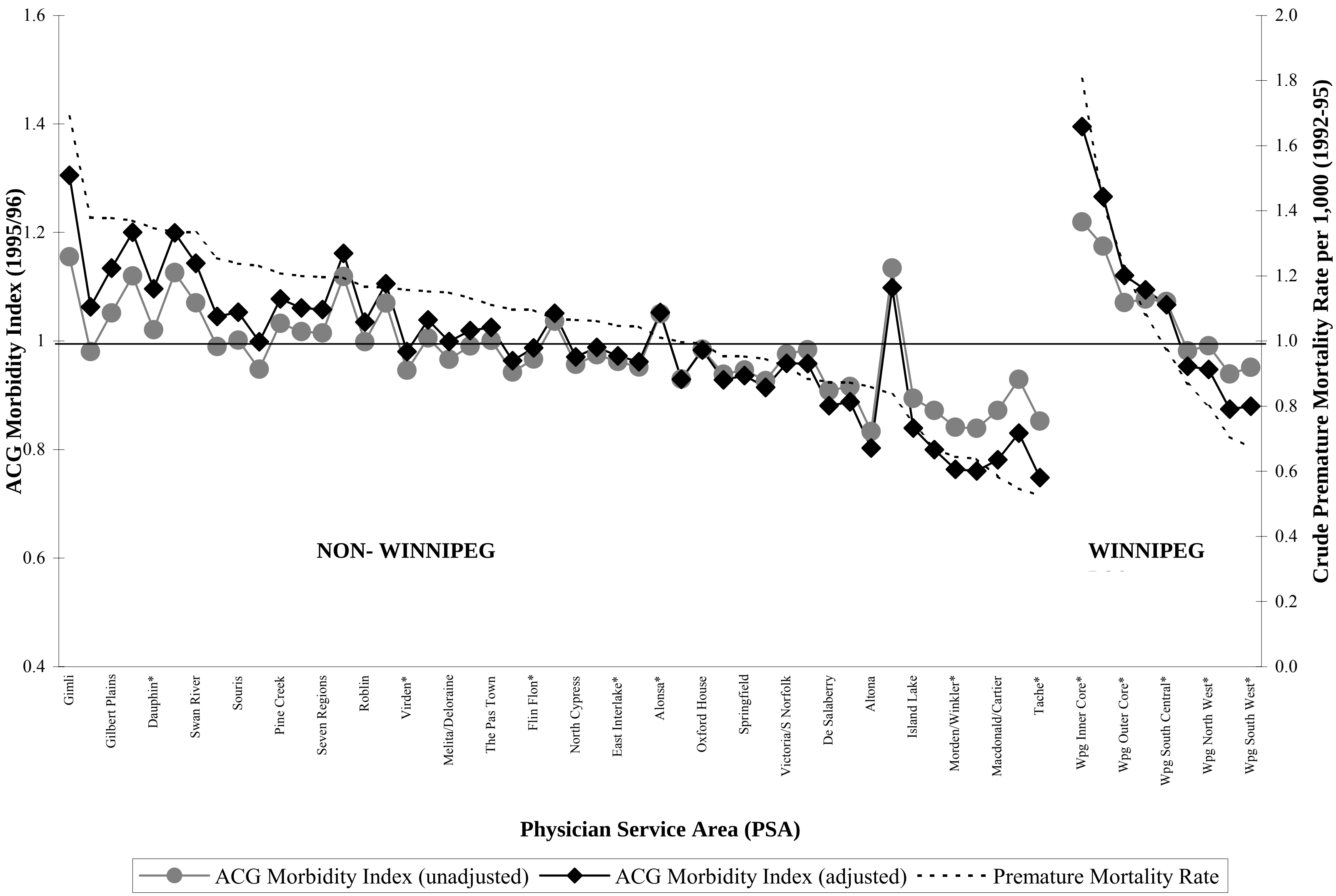
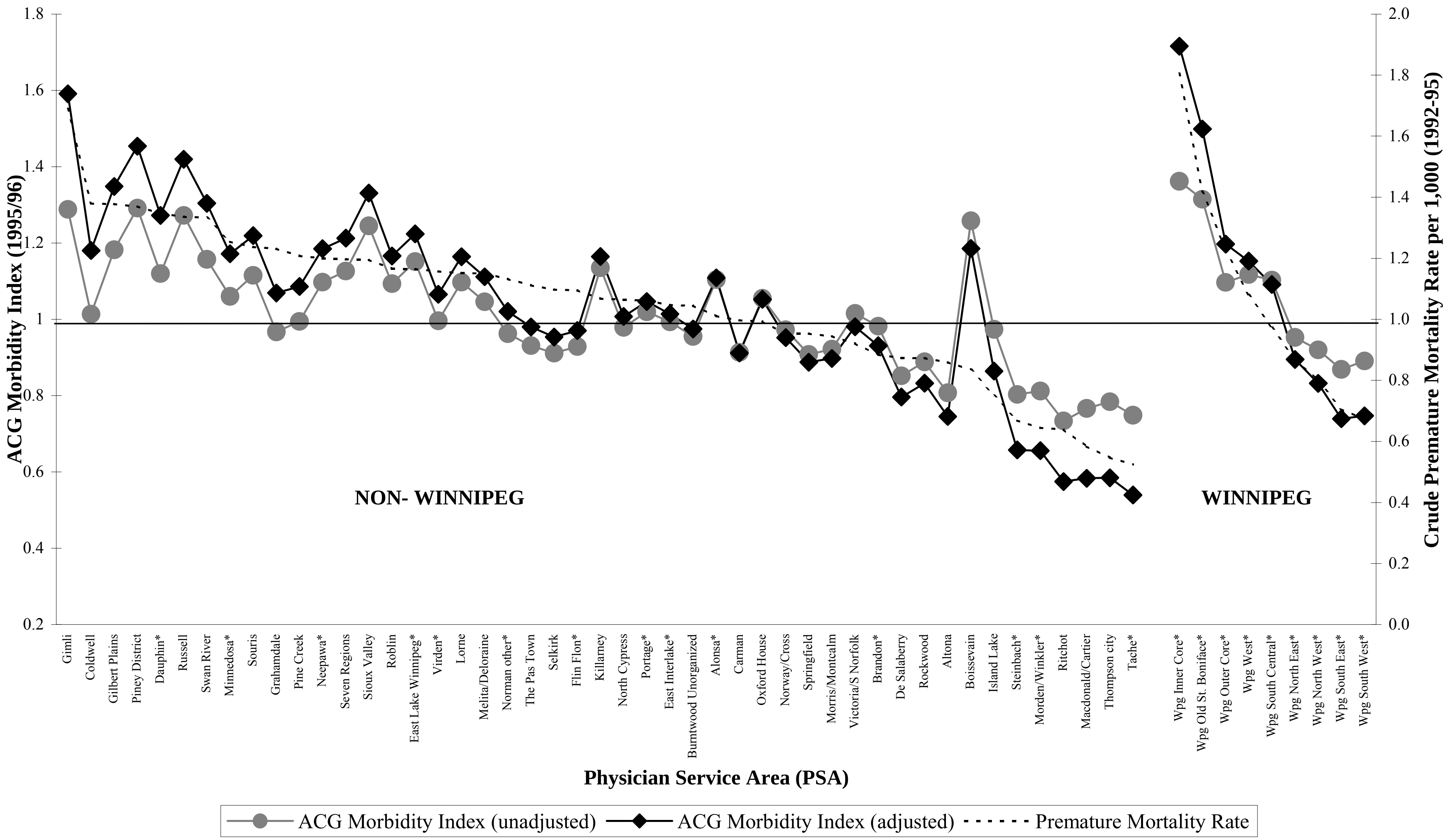


Figure 14: Comparison of Adjusted &Unadjusted ACG Morbidity Indices (using Physician Costs) and Premature Mortality Rate for Manitoba's Physician Service Areas (PSAs)



*Areas where the study practices are located.

Figure 15: Comparison of Adjusted &Unadjusted ACG Morbidity Indices (using Total Costs) with Premature Mortality Rate for Manitoba's Physician Service Areas (PSAs)



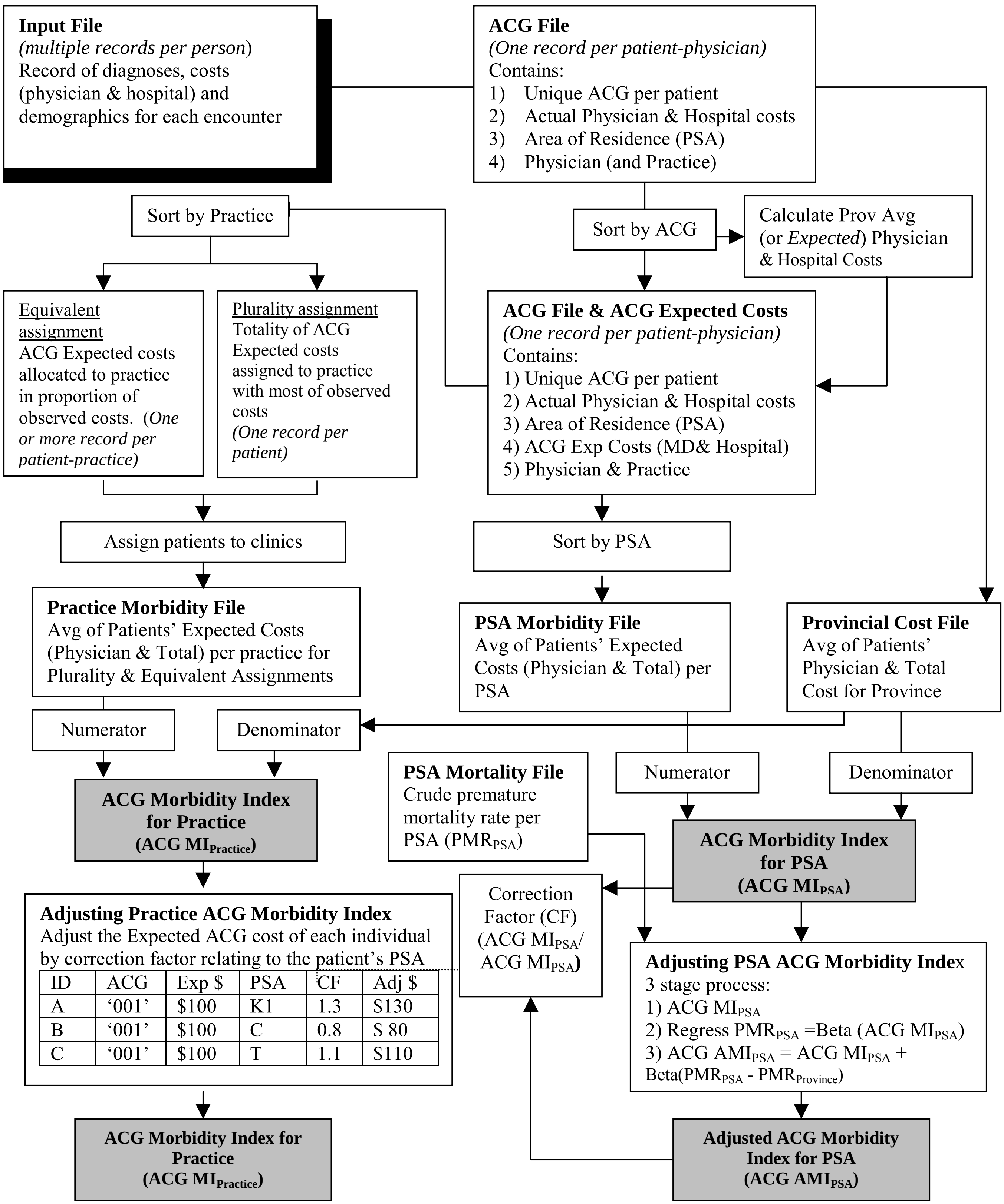
*Areas where the study practices are located.

As previously reported(Reid et al. 1999), the unadjusted ACG index has a strong positive linear relationship with the crude premature mortality rate. The association is slightly stronger for the index weighted with total costs (r=0.81) compared with that weighted with physician costs (r=0.76) but the difference is not large. As expected, the adjustment process strengthens both these associations (r=0.91 and r=0.93). The adjustment process resulted in making some indices larger, some smaller, and many remained relatively unchanged. On the whole, the effect was to reduce the indices for PSAs with low relative mortality (i.e., make them appear slightly *healthier*) and increase the index for PSAs with high mortality (i.e., make them appear slightly *sicker*). (The correlation between premature mortality and the difference in the indices was r=0.81.) Overall, the changes were relatively modest for the physician cost indexes (mean change 4.7%; SD 3.5%) and more pronounced for the total cost indices (mean change 9.3%; SD 7.1%). The patterns of adjustment were similar for rural and urban PSAs.

Applying the Correction Factor to the Practice-based Morbidity Indices

Our procedure for correcting the practice-based is outlined in Figure 16. For illustrative purposes, we also calculate adjusted index for our hypothetical practice of five patients (Table 6). The correction factor (row K) is applied to each patient's ACG expected costs. The practice-level ACG morbidity index is then calculated in our usual manner using the plurality or equivalent assignment approaches.

Figure 16: Applying and Adjusting ACG Morbidity Indices to Physician Practices



ID	ACG	Exp $	PSA	CF	Adj $
A	'001'	$100	K1	1.3	$130
B	'001'	$100	C	0.8	$ 80
C	'001'	$100	T	1.1	$110

Table 6: Adjusting the ACG Morbidity Index for a Hypothetical Practice with Five Patients

Patient Characteristic			**Patient I**	**Patient II**	**Patient III**	**Patient IV**	**Patient V**	**Clinic Total**
Age (y)			45	26	5	63	34	-
Sex			M	F	M	M	F	-
Residential Physician Service Area (PSA)			K1	K1	K1	C	T	-
Ambulatory Care Group (ACG)			900	1600	200	4420	3400	-
Actual Costs ($)	Total	(A)	160	30	100	300	100	-
	Clinic A	(B)	128	30	40	120	20	-
	Oth Clinic B	(C)	0	0	60	100	0	-
	Oth Clinic C	(D)	32	0	0	80	80	-
Patient Assignment (Clinic A)	**Discrete**	**(E)**	1	1	1	1	1	5
	Plurality	(F)	1	1	0	1	0	3
	Equivalent	(G)=(B/A)	0.8	1	0.4	0.4	0.2	2.8
ACG Expected Costs ($) for Clinic A	Total	(H)	90	50	70	450	190	-
	Plurality	(I)=(HxF)	90	50	0	450	0	**590**
	Equivalent	(J)=(HxG)	72	50	28	180	38	**368**
PMR-based Adjustment Factor		(K)	1.3	1.3	1.3	0.8	1.1	**-**
Adj ACG Expected Costs ($) for Clinic A	Total	(L)=HxK)	117	65	91	360	209	**-**
	Plurality	(M)=IxK)	117	65	0	360	0	**542**
	Equivalent	(N)=JxK)	93.6	65	36.4	144	41.8	**380.8**

ACG Morbidity Index (Clinic A) = Avg. ACG Expected Costs / Avg. Provincial Cost
Plurality Approach: = (590 / 5) / 259 = 0.46
Equivalent Approach: = (368 / 3) / 259 = 0.47

Adjusted ACG Morbidity Index (Clinic A) = Avg. ACG Expected Costs / Avg. Provincial Cost
Plurality Approach: = (542 / 5) / 259 = 0.42
Equivalent Approach: = (380.8 / 3) / 259 = 0.49

Table 7 presents the adjusted indices for the 29 study clinics. The adjustment process did little to alter the distribution of the morbidity indices for the urban clinics (constructed with physician costs) but it resulted in a wider distribution for the rural ones (Figure 17). More specifically, in most of the urban clinics, the adjustment process resulted in a change of less than 2% in the index while the mean change for the rural clinics was 5% (Figure 18). As with adjustment at the PSA level, the adjustment tended to accentuate the indices in both directions (i.e., the healthy became healthier and the sick became sicker) for the rural clinics. The strength of the linear relationship with mean practice age did change (Pearson's coefficient=0.67) (Figure 19). These effects were similar but more pronounced for the total cost indices.[12]

Thus, the principal effect of the PSA-level adjustment of the practice-level indices using the premature mortality rate was directed primarily at the rural practices. Little effect was seen for the urban clinics. Did it correct the apparent anomalies in the unadjusted indices when compared to practice mean age? The answer is a cautious 'somewhat'. For clinic R13, the index changed from indicating that the clinic was 9% healthier than the provincial average to only 4% healthier. However, this is still at odds with the relatively high mean age for this population, which indicates that the clinic population is likely, sicker. For clinic R10, the index showed about a 5% change (1.07-1.12) in the hypothesized direction. Thus, the adjustment appeared to partially correct the suspect bias present in the indices for these clinics. However, because we did not alter any of the patient ACG assignments with this correction, the index continues to suggest that these populations are healthier than we expect that they really are.

[12] How is it that the adjustment results in more changes for the rural clinics than urban clinics, in light of the similar effects of adjustment among urban and rural PSAs? A partial explanation relates to the fact that urban practice populations come from a wider variety of different PSAs than rural practices. Since urban clinics see patients from many different PSAs (some with negative and some positive corrections), the practice adjustment is dampened or nullified.

Table 7: Adjusted ACG Morbidity Index for Study Practices, 1995/96

		Plurality Approach*						Equivalent Approach*					
		Total ACG Expected Costs (x$1,000)		Average ACG Expected Costs ($)		ACG Morbidity Index**		Total ACG Expected Costs (x$1,000)		Avg ACG Expected Costs ($)		ACG Morbidity Index **	
		Physician	Total	Physician	Total	Physician	Total	Physician	Total	Physician	Total	Physician	Total
Urban Clinics	U1	17,526	49,736	363.07	1,071.98	1.40	1.36	13,592	44,249	341.56	1,098.34	1.32	1.37
	U2	15,874	43,969	319.86	880.87	1.23	1.11	12,532	39,948	309.90	907.79	1.20	1.14
	U3	5,802	16,208	300.76	849.41	1.16	1.07	5,588	16,034	277.32	793.76	1.07	0.99
	U4	8,037	22,791	303.30	873.82	1.17	1.11	6,671	20,728	292.95	892.41	1.13	1.13
	U5	3,394	9,367	285.47	787.56	1.10	1.00	2,770	8,587	268.85	807.55	1.04	1.00
	U6	1,403	3,549	227.23	569.54	0.88	0.72	1,373	3,460	217.03	546.61	0.84	0.68
	U7	1,932	4,433	241.10	561.67	0.93	0.71	1,717	4,231	229.87	570.41	0.89	0.69
	U8	1,653	5,288	294.00	933.44	1.13	1.18	1,558	5,030	282.41	909.39	1.09	1.15
	U9	1,127	1,906	211.36	364.80	0.82	0.46	1,092	2,116	207.83	411.38	0.80	0.47
	U10	2,109+	4,968	262.33	632.01	1.01	0.80	1,703	4,560	247.40	671.81	0.95	0.77
	U11	1,011	1,983	247.05	492.60	0.95	0.62	1,041	1,974	238.15	462.28	0.92	0.61
	U12	1,302	3,148	194.49	467.08	0.75	0.59	1,069	3,005	192.23	534.13	0.74	0.61
	U13	594	994	207.79	354.53	0.80	0.45	646	1,118	211.44	374.42	0.82	0.48
	U14	518	787	191.05	294.60	0.74	0.37	581	987	194.44	337.56	0.75	0.40
	U15	719	1,279	219.09	403.45	0.85	0.51	645	1,272	220.06	448.05	0.85	0.54
Rural Clinics	R1	4,511	13,900	280.58	862.52	1.08	1.09	3,947	12,464	266.02	821.23	1.03	1.07
	R2	3,036	7,193	240.48	570.99	0.93	0.72	2,611	7,849	277.81	688.20	0.88	0.71
	R3	3,385	10,210	321.60	997.58	1.24	1.26	2,904	8,515	308.13	896.89	1.19	1.26
	R4	1,537	3,428	228.69	522.79	0.88	0.66	1,430	3,283	219.91	516.21	0.85	0.65
	R5	1,858	4,809	240.44	628.22	0.93	0.79	1,668	5,246	230.06	716.16	0.89	0.78
	R6	1,459	4,062	223.47	607.74	0.86	0.77	1,301	4,331	211.90	677.05	0.82	0.75
	R7	1,134	2,501	225.19	505.54	0.87	0.64	946	2,829	212.48	632.04	0.82	0.64
	R8	980	2,389	288.56	711.56	1.11	0.90	924	2,235	274.99	665.29	1.06	0.89
	R9	1,175	3,669	308.08	962.44	1.19	1.22	1,015	3,064	291.45	866.31	1.12	1.16
	R10	1,086	3,386	292.39	904.00	1.13	1.14	971	2,905	280.00	813.70	1.08	1.13
	R11	1,119	3,396	303.18	928.50	1.17	1.17	946	2,813	287.31	840.04	1.11	1.14
	R12	1,078	3,108	296.46	859.38	1.14	1.09	936	2,820	284.10	835.69	1.10	1.08
	R13	821	2,403	245.42	715.53	0.95	0.91	748	2,107	237.15	658.62	0.92	0.89
	R14	716	2,099	296.02	863.46	1.14	1.09	592	1,779	276.95	797.77	1.07	1.06

* Plurality refers to assignment based on practice where patient received plurality of costs ('physician' or 'total' costs). For 'equivalent' approach, patients are weighted by proportion of costs attributed to practice.

** Average ACG expected costs divided by average provincial costs.

Figure 17: Distribution of Unadjusted & Adjusted ACG Morbidity Indices for Urban and Rural Clinics

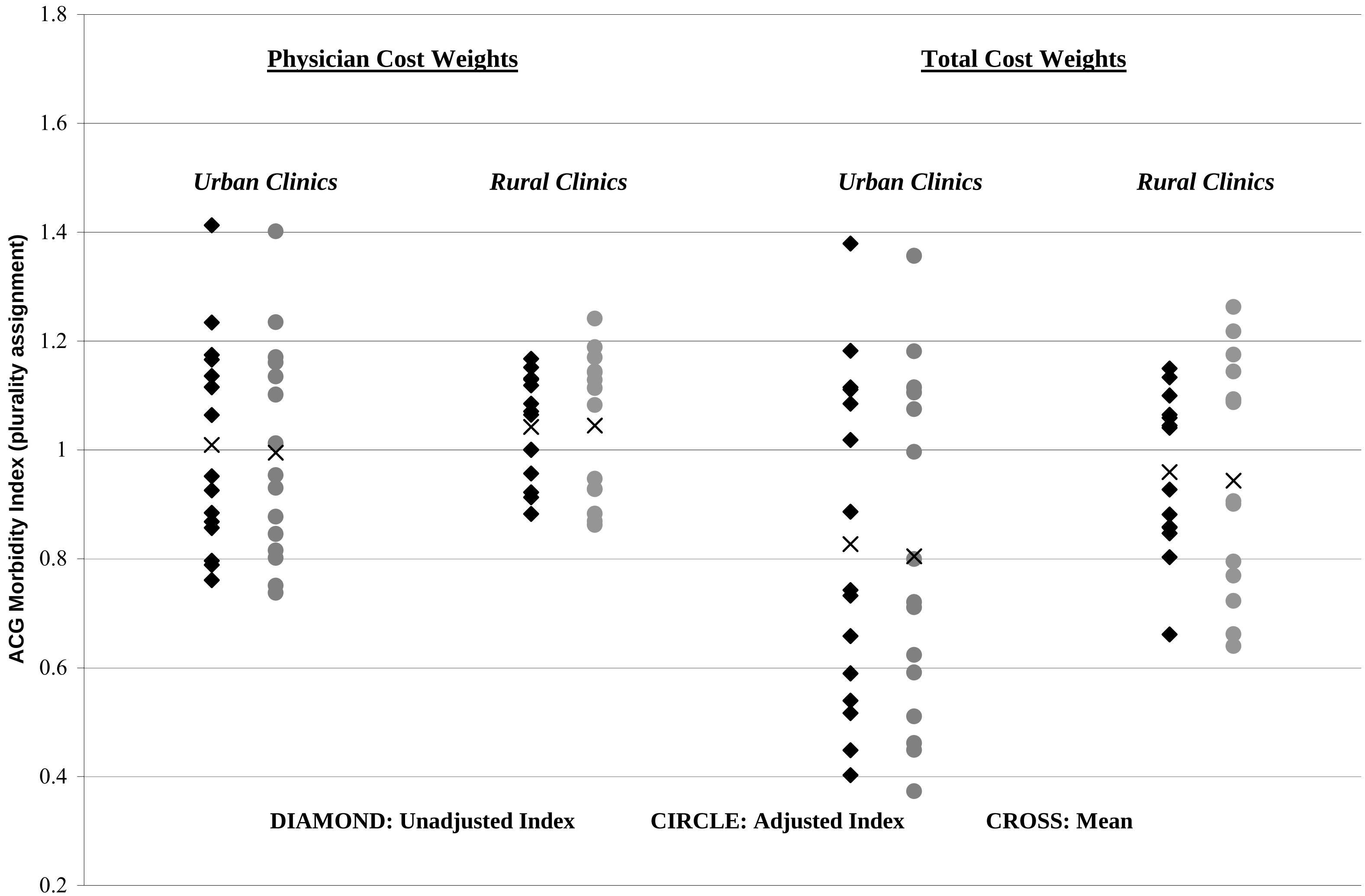


Figure 18: Comparison of Adjusted & Unadjusted ACG Morbidity Indices, Mean Age & Percent Consults (*indices constructed with plurality assignment and physician cost weights*)

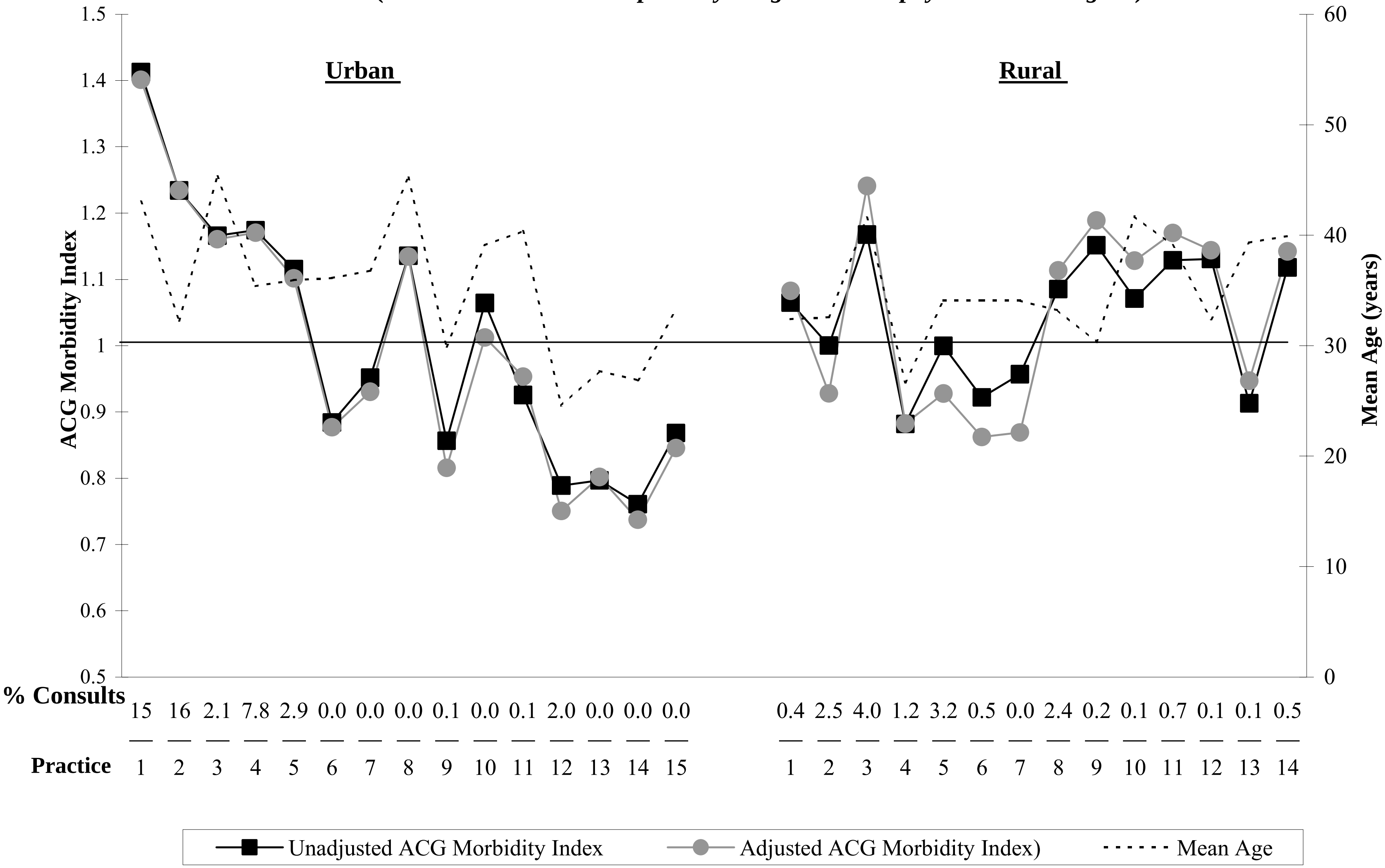
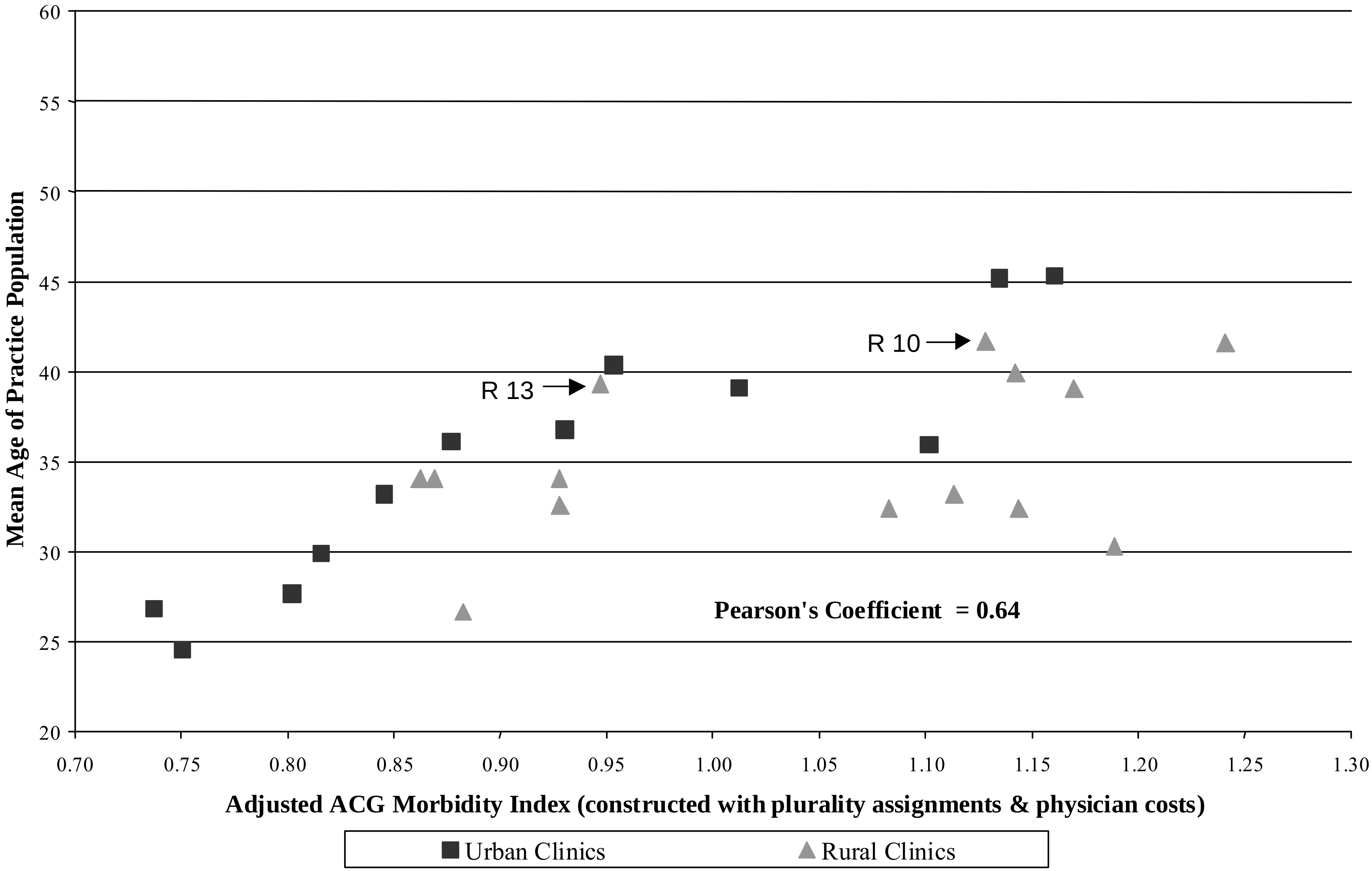


Figure 19: Scatterplot of Adjusted ACG Morbidity Index and Mean Age of Practice Populations



Only twelve urban clinics are shown here, as the remaining three had a relatively high proportion of specialist visits.

Table 8 summarizes the correlations between the ACG morbidity indexes differentiated by the methods of patient assignment, weighting, and adjustment. The correlations suggests that the morbidity indices are highly related to each other regardless of which assignment approach is taken, the weighting scheme, or whether or not they are adjusted using the premature mortality rate. The index most highly related to the average age of the plurality patients is the one constructed with the plurality assignments, the total cost weights, and adjusted with premature mortality (r=0.62).

2.5 Practice and Geographic-based Morbidity Profiles: How Do They Compare?

The prior sections reveal that the ACG morbidity indices vary tremendously across practices and geographic small areas, both in relation to the need for physician services and the need for physician and hospital services combined. A supplemental question asks "how does the practice-based morbidity index compare to that for the geographic area in which the practice is situated?" In other words, do differences in the burden of morbidity seen at the practice level merely reflect the differences seen at the regional level?

To shed light on this question, we examine the ACG indices for our study practices in comparison to the PSAs in which the largest portion of their practice population resides. Figure 20 shows the practice-based indices (adjusted and based on total costs), the PSA-based indices, and the proportion of the practice population originating from the PSA. Not surprisingly, we found that the larger the proportion of the practice that came from the PSA, the smaller the difference between the indices (Figure 21). For urban practices that originate from multiple regions, the practice and PSA-level indices differed by a median of 30% (interquartile range 57%). For rural practices where most patients come from the surrounding locale the practice-based indices were similar to the PSA-based ones with a median difference of 8% (interquartile range 12%). These findings suggest that practices can and do differ substantially in their morbidity patterns compared to the regional profiles. These differences likely relate to the fact that local patients choose certain clinics preferentially and that patients often come from areas that are further afield.

Table 8: Pearson Correlation Matrix between ACG Morbidity Indices, Mean Age, and Mean Income Quintile for Practice Populations

a. Plurality Assignment

			Mean Income Quintile	Mean Age	ACG Morbidity Index: Physician Costs		ACG Morbidity Index: Total Costs	
					Crude	*Adjusted*	*Crude*	*Adjusted*
	Mean Income Quintile		1.00	-0.01	-0.11	-0.22	-0.22	-0.31
	Age (mean)		——	1.00	0.60	0.61	0.59	0.62
ACG Morb Index	**Physician Costs**	**Crude**	——	——	1.00	0.98	0.94	0.92
		Adjusted	——	——	——	1.00	0.92	0.95
	Total Costs	**Crude**	——	——	——	——	1.00	0.97
		Adjusted	——	——	——	——	——	1.00

b. Equivalent Assignment

			Mean Income Quintile	Mean Age	ACG Morbidity Index: Physician Costs		ACG Morbidity Index: Total Costs	
					Crude	*Adjusted*	*Crude*	*Adjusted*
	Mean Income Quintile		1.00	-0.01	-0.12	-0.24	-0.23	0.23
	Age (mean)		——	1.00	0.56	0.58	0.56	0.58
ACG Morb Index	**Physician Costs**	**Crude**	——	——	1.00	0.97	0.93	0.92
		Adjusted	——	——	——	1.00	0.90	0.95
	Total Costs	**Crude**	——	——	——	——	1.00	0.97
		Adjusted	——	——	——	——	——	1.00

Figure 20: Comparison of Practice-based & Physician Service Area-based Adjusted ACG Morbidity Index

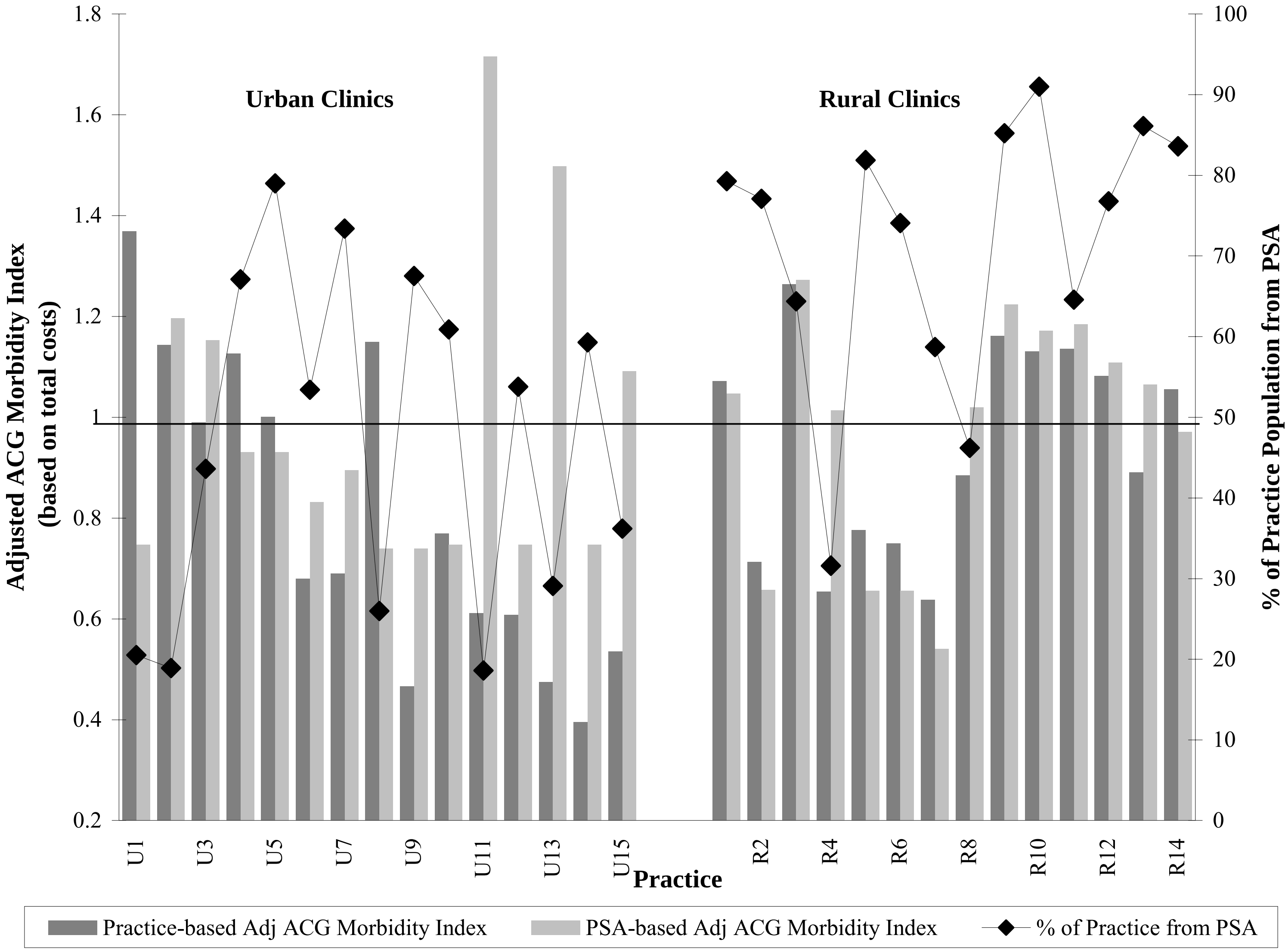
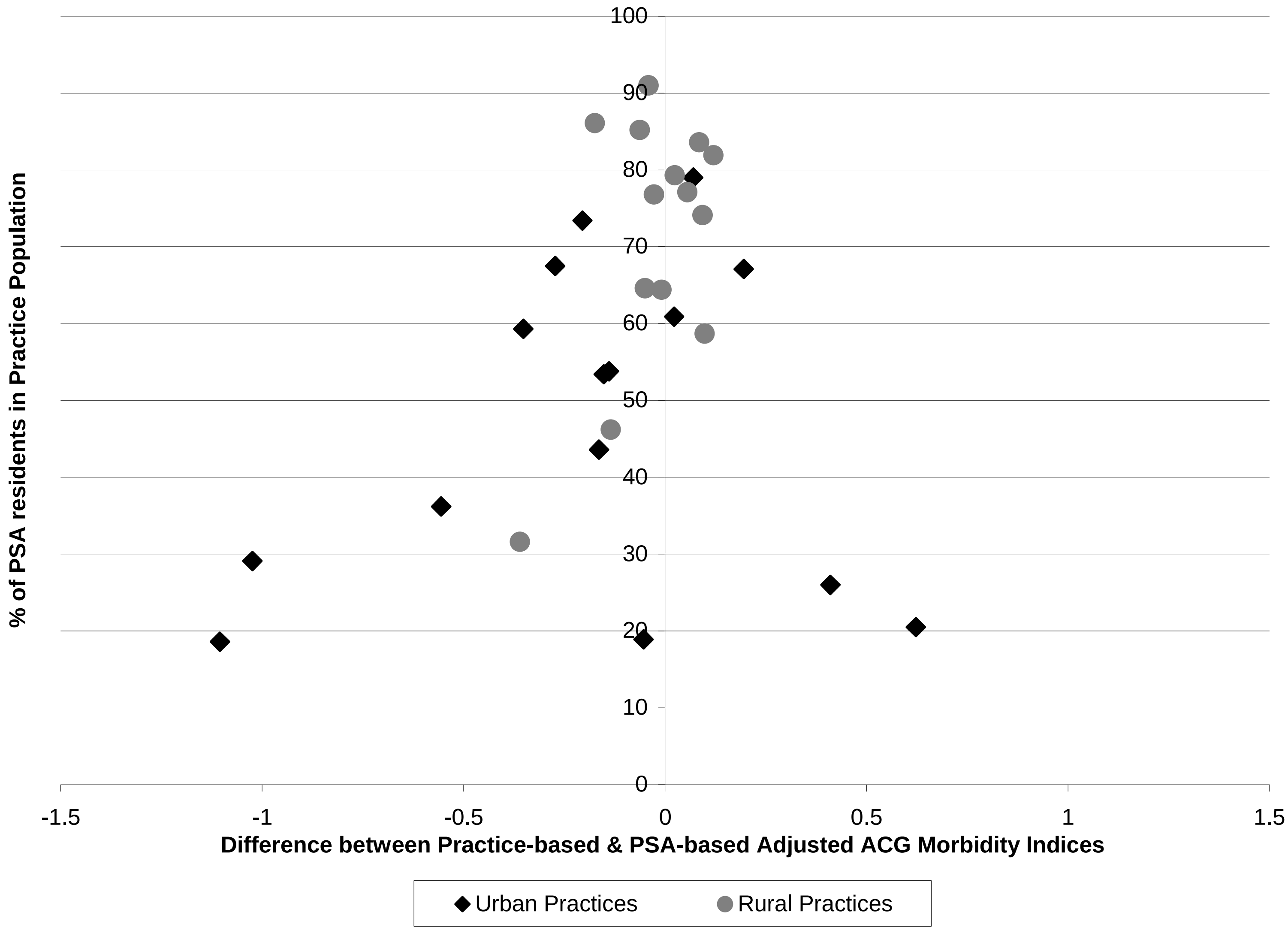


Figure 21: Difference between Practice and PSA-based ACG Morbidity Indices & Percent of Practice Population from Physician Service Areas (PSAs)



3.0 DISCUSSION

This study revealed some important features regarding how Manitoba practices are organized to provide care to patients and how they differ with respect to the populations they serve. The following are the study's main findings:

1. The ACG Morbidity Index appears to be a useful way to examine differential morbidity at the practice level.

Methods to quantify and differentiate overall illness levels among physician practices are critical to the successful application of a variety of policy applications under consideration including prospective funding and 'physician profiling'. Understanding how morbidity is distributed across practice has important applications in deciding physician resource requirements. As opposed to using other health status and needs indicators in the context of physician practices, the ACG morbidity index has the advantage that it uses existing data and can be applied to relatively small populations over short intervals. Our study suggests substantial validity of the ACG index; it varies in expected ways with other aspects of the practice population known (or hypothesized) to be related with morbidity including primary/specialty care mix, mean age and socioeconomic status. Several practices appear to have lower indices that would be expected, raising the possibility of less specific diagnosis coding at these clinics.

We found no significant benefits to our adjustment of the ACG index with premature mortality. Given the complexities of its application and the small changes that resulted, we do not recommend this methodology. However, we remain somewhat concerned about the potential for underrepresenting morbidity in some populations. More research is underway to determine the usefulness of adding individual-level socioeconomic status to the case-mix model.

In this study, we examined a variety of practices with diverse organizational forms including general practitioner only clinics and multidisciplinary clinics. In applying prospective funding and/or physician profiling, however, more work is required to further differentiate these clinics by their role and the types of services they perform.

2. Morbidity is not randomly distributed across practices. Some practices serve a much healthier set of patients, regardless of how patients are assigned to the practice, or how ACGs weighted.

Our study suggests substantial differences in the morbidity levels among large clinical practices in Manitoba. These differences persist regardless of whether practices are defined to include only those patients who receive the greatest share of their care at the respective clinic or whether they are defined by all the patients seen by clinic physicians. This finding suggests that attention needs to be focused on this issue of case-mix adjustment when per capita payments are used or practitioner performance profiles are generated. Without adequate attention to case mix, health care administrators will potentially under-fund practices with sicker patients or flag them as inefficient providers. Moreover, this situation creates per capita funding incentives for physicians to select to care for healthier patients and avoid the sicker ones (i.e., the phenomenon of adverse selection).

3. Larger case-mix differences exist among practices in their needs for physician and hospital care vs. their need for physician care only.

We found larger differences in the overall illness levels between practices when illness was specified in relation to physician and hospital services combined compared to when specified for physician services only. To the extent that high-risk populations of low socioeconomic status tend to have fewer than expected contacts with physicians, we would expect the combined weights to somewhat adjust for an underrecording of diagnoses bias and more accurately reflect patient need. Alternatively, even if there were no such diagnostic underrecording, it is worth considering whether the weights which include hospital costs might better reflect the relative amounts of care which it is appropriate to encourage physicians to provide to high risk/need versus low risk/need patients.

4. More variation exists in illness levels among urban clinics than rural ones.

Among the 15 urban clinics studied, we found more variation in overall illness levels than among the 14 rural clinics. In other words, the relatively ill or well are more likely to concentrate their care in specific clinics within the Winnipeg region than elsewhere in the province. This finding suggests that case-mix measurement and adjustment for population-based policies may be especially critical when applied to physician practices in urban areas.

5. Substantial overlap among practice populations exists and this overlap is greater for urban compared to rural clinics.

Our sample of clinics varied substantially in the degree that they 'shared' patient care with other clinics. Some clinics delivered the plurality of care to about one quarter of the patients that they see whereas some provide the plurality of care to 75% or more. This suggests that clinics vary considerably in the patient care roles they play, the strength of the relationships between patients and providers, and the degree that their patient populations overlap with those of others. This patient 'sharing' is an important issue when applying capitation payments or generating patient-based practice profiles.

6. Large differences exist for some clinics and small differences for others in how their illness levels compare to that of the population in the immediate vicinity.

When compared to the population in the immediate geographic vicinity, the overall illness levels were similar for some clinics but quite different than others. This finding implies that morbidity is not randomly distributed among clinics in a given area and/or patients may visit clinics in other geographic areas for much of their care. This finding also suggests that case-mix adjustment for geographic areas may not translate adequately when applied to the physician practice level.

7. Most general and family practice physicians in Manitoba do not practice in group settings. Although not examined in this report, careful attention is necessary before applying capitation payments and/or physician profiling to small practices.

This analysis only applies to the 29 group practices in the province which have four or more physicians[13]. More than half of the provinces general and family practice physicians are therefore not included in the analysis. Although not examined, the

[13] Practice group could not be determined for the 270 physicians submitting paper claims, so there may in fact be more groups meeting the four FTE criteria than we have identified.

quantification of morbidity in small practices is difficult because of their increased susceptibility to the effects of misclassification and random error. While U.S. researchers have applied ACGs for practice populations as low as 400 patients, more research is required to validate the ACGs for small practices.

4.0 APPENDICES

Appendix A: Definition and Selection of Study Practices

The physician practices that were examined in this report were the same as those identified by Menec (Menec et al. 2000). We focused only on groups that were comprised of four or more GP/FP full-time equivalents since smaller groups were less likely to be considered for alternative payment and because of the potential instability of their performance profiles. In Manitoba, there is no easy way to link physicians to the practices with which they are affiliated. We relied on the 'site code' from fee-for-service electronic billing clams to identify groups. Since physicians working at the same clinic use the same site code, this permitted us to group physicians billing fee-for-service into practice groups. (Practice group could not be determined for the 270 physicians submitting paper claims, so there may in fact be more groups meeting the four FTE criteria than we have identified.)

We included practices that (1) had a site code and (2) had four or more full-time equivalent (FTE) general/family physicians. We defined full-time equivalence in terms of the workload of a "typical" general/family physician. In essence, this FTE measure provides an estimate of the average number of visits made to a general/family physician in different regions of the province (see Roos et al, 1996 for details). To determine the number of FTEs affiliated with a particular practice, we therefore divided the total number of visits made to the clinic by the workload of a typical general/family physician in that region. Thus, this FTE measure is group-based rather than physician-based and has the advantage of accounting for physicians who move between clinics. Further details on this method are provided elsewhere (Menec et al., 2000).

Appendix B: Costing of Hospital Services

Background

Hospitals in Manitoba are funded by a global budget rather than for individual services. Consequently, we employed a 'top-down' case-mix costing methodology to estimate patient-specific hospital costs. This method starts at the top with total expenditures and then divides these by a measure of total output. It has been used in various research projects by MCHPE (Jacobs et al. 1999; Shanahan et al. 1994; Shanahan 1996; Shanahan et al. 1997; Shanahan et al. 1998). This method goes further than a per diem costing methodology by dividing patients into groups that are clinically meaningful and homogeneous with respect to expected hospital expenditures. Patients are assigned higher weights if they are expected to consume more resources. Weights can be adjusted depending on whether the case is typical or atypical (see below). This method of case-mix hospital costing uses total hospital costs as the numerator (as is the case if one were to calculate unadjusted per diem rates), but rather than dividing by the number of patient days to find an "average" cost per day, it is divided by the sum of the case-mix weights to estimate the cost per weighted case (CWC).

It is important to note that:

1. The cost assigned to a case is for a complete course of treatment, and dividing the cost by the length of stay will not accurately reflect the costs of any particular day.
2. The cost for a case is an estimate of the average cost for that particular type of case, and may not accurately reflect the actual cost of a specific case.
3. The cost for a particular type of case is calculated as a value relative to all other types of cases.
4. Weights were not developed from Manitoba cost data. Maryland Health Services Cost Review Commission (HSCRC) 1991 and 1992 data were used to calibrate Manitoba (RDRG) weights and costs.

We used the Refined Diagnostic Related Group (RDRG) classification system to group inpatient cases into clinically meaningful resource use (Canadian Institute for Health Information 1994a). The RDRG system allows for differing levels of severity based on complications and co-morbidities within similar diagnostic groupings. Relative case weights

(RCWs) were developed based on charge data from Maryland and Manitoba lengths of hospital stay (LOS). Average LOS (ALOS) and trim point (the point after which a length of stay is determined to be abnormally long) for typical patients were also developed for Manitoba patients for each RDRG.

For outpatient care, Day Procedure Groups (DPGs) and weights were available from the Canadian Institute for Health Information (Canadian Institute for Health Information 1994b).

<u>Details of Costing Methods</u>

Using 1996/97 patient hospital data, all inpatient hospital days were classified into RDRGs (version 9); each was weighted using Manitoba RCWs. Adjustments were made to the weights for atypical cases (cases involving non-acute days, outliers (LOS>Trim), transfers or deaths). For example, for cases with LOS>Trim, a marginal case weight was added to the RCW for every day that the LOS was past the average LOS (that is, case weight = RCW + Marginal case weight * (LOS - ALSO). Marginal case weights were developed for each RDRG.

For each hospital these case weights were summed. Hospital-specific average case weights were calculated by summing all the case weights in each hospital and dividing by the total number of hospital cases. Hospital average costs per weighted case (CWC) were calculated by dividing the total inpatient dollars by the total hospital case weights. (See following for how the hospital inpatient dollars were identified.) The hospital average cost per weighted case (CWC) was the focus. The CWC for a hospital represents an average cost per case adjusted for the types of patients treated in that hospital.

CWC (per hospital) = Total $ per hospital / Sum of all RCW (per hospital)

To find the cost of a particular case:

*Cost of a case = CWC * RCW for that case*

Day care surgery costs were estimated using the DPG to classify cases and apply appropriate weights. The DPG weight was then multiplied by the CWC for the hospital providing the care to obtain an estimated cost per case.

*Estimated day surgery cost for a case = DPG weight * CWC for that hospital*

For each patient, the inpatient and day procedure costs, if any, were combined.

Source of Global Budgets

The primary source of financial data was the Statistics Canada HS-1 database. This information was supplemented with data from various other sources.

Hospital Statistics Part 1 (HS-1): Prior to 1995/96 all hospitals annually filed HS-1 data collection forms with Statistics Canada. The HS-1 consisted of hospital costs and statistics in an aggregate form.

Financial Information Systems (FIS): used to provide audited and inventory- adjusted cost data for drugs and medical and surgical supplies for the rural hospitals

Laboratory and Imaging Services (LIS): provides diagnostic services for many rural hospitals.

Community Therapy Services (CTS) and South Central Therapy Services (SCTS): cost data on occupational therapy and physiotherapy provided by outside agencies.

Some costs were excluded, such as medical reimbursements, medical housestaff salaries, capital costs and depreciation, and costs not directly related to patient care, such as education and research programs.

Appendix C: ACG-specific Cost Distributions

Table A3:Distribution of Physician Expenditures (Trimmed Outliers)* by ACG Category, Manitoba 1995/96

ACG	Description	n	Mean ($)	cv ($)	Min ($)	25° ($)	Med ($)	75° ($)	Max ($)
100	Acute Minor Age 1-2	2207	95.31	0.59	15.29	52.92	87.59	124.66	275
200	Acute Minor Age 3-5	13167	65.15	0.71	15.00	31.93	53.89	86.62	227
300	Acute Minor Age 6+	127525	55.15	0.91	3.65	16.64	35.70	70.37	268
400	Acute Major	34208	82.96	1.30	5.00	17.44	48.95	93.44	681
500	Likely to Recur, without Allergies	44014	61.72	1.08	6.97	16.64	36.89	75.00	356
600	Likely to Recur, with Allergies	2619	72.35	1.06	10.00	17.44	48.24	89.55	389
700	Asthma	3485	51.60	0.89	11.19	16.64	34.08	64.59	220
800	Chronic Medical, Unstable	6555	141.21	1.22	10.81	39.91	85.65	167.92	949
900	Chronic Medical, Stable	23961	88.04	0.87	10.81	32.70	65.98	118.85	415
1000	Chronic Specialty, Stable	1081	53.01	1.07	15.05	16.64	33.70	66.01	342
1100	Ophthalmological / Dental	8225	58.36	1.50	8.62	29.35	29.35	57.67	535
1200	Chronic Specialty, Unstable	3106	68.97	1.20	11.76	23.05	45.20	76.25	434
1300	Psychosl, without Psychosl Unstable	7670	129.04	2.06	10.81	16.64	48.05	106.95	1623
1400	Psychosl, c/ Psychosl Unstab, c/o Psychosl,Stab	1240	231.05	1.59	13.86	33.28	88.19	234.26	1769
1500	Psychosl, with Psychosl Unstab, c Psychosl Stab	526	554.83	1.31	21.20	126.55	260.64	629.45	3298
1600	Preventive / Administrative	26883	51.23	0.71	3.09	32.71	37.35	56.22	266
1711	Pregnancy: 0-1 ADGs, delivered	1286	135.42	0.76	1.83	57.26	108.01	187.45	471
1712	Pregnancy: 0-1 ADGs, not delivered	427	105.89	0.74	15.25	47.96	85.27	143.95	357
1721	Pregnancy: 2-3 ADGs, no maj ADG, delivered	4957	213.67	0.63	4.24	112.80	183.30	289.37	640
1722	Pregnancy: 2-3 ADGs, no maj ADG, not delivered	2037	185.15	0.56	17.44	111.35	163.22	234.50	538
1731	Pregnancy: 2-3 ADGs, 1+ maj ADG, delivered	876	217.56	0.71	1.83	103.55	183.13	296.71	781
1732	Pregnancy: 2-3 ADGs, 1+ maj ADG, not delivered	189	226.66	0.62	33.79	129.76	192.91	286.43	741
1741	Pregnancy: 4-5 ADGs, no maj ADG, delivered	3153	311.13	0.52	28.58	192.59	281.59	402.19	832
1742	Pregnancy: 4-5 ADGs, no maj ADG, not delivered	1918	276.60	0.49	65.40	182.41	245.93	334.10	752
1751	Pregnancy: 4-5 ADGs, 1+ maj ADG, delivered	1586	342.68	0.63	16.64	192.29	294.41	422.89	1110
1752	Pregnancy: 4-5 ADGs, 1+ maj ADG, not delivered	607	345.45	0.66	46.44	198.70	284.56	408.67	1217
1761	Pregnancy: 6+ ADGs, no maj ADG, delivered	1460	451.61	0.48	62.00	299.24	409.29	557.51	1212
1762	Pregnancy: 6+ ADGs, no maj ADG, not delivered	1294	420.01	0.48	100.43	276.06	372.72	505.76	1136
1771	Pregnancy: 6+ ADGs, 1+ maj ADG, delivered	1922	590.80	0.63	65.07	339.53	492.44	709.43	1931
1772	Pregnancy: 6+ ADGs, 1+ maj ADG, not delivered	1339	611.80	0.75	85.55	342.30	474.90	701.22	2779
1800	Acute Minor and Acute Major	52813	143.86	0.86	6.97	65.60	106.83	174.25	695
1900	Acute Minor and Likely to Recur, Age 1-2	5337	191.04	0.60	16.64	112.06	163.03	238.10	616
2000	Acute Minor and Likely to Recur, Age 3-5	15574	139.60	0.67	16.64	74.89	113.78	173.60	462
2100	Acute Minor and Like to Recur, Age >5, c/o All.	61046	122.04	0.77	6.97	58.60	94.31	151.31	474
2200	Acute Minor and Likely to Recur, Age >5, c All.	5238	146.06	0.78	24.60	65.99	113.04	182.29	554
2300	Acute Minor and Chronic Medical: Stable	22151	141.98	0.69	15.85	69.15	116.35	185.58	522
2400	Acute Minor and Eye / Dental	6967	111.10	0.90	15.85	51.71	79.87	127.82	599
2500	Acute Min with Psychosl Stab c/o Psychosl Unst	9471	168.16	1.29	15.29	63.40	104.90	179.18	1380
2600	Acute Min c/o Psychosl Stab c Psychosl Unstab	813	243.75	1.31	15.85	78.69	133.13	256.58	1840

ACG	Description	n	Mean ($)	cv ($)	Min ($)	25° ($)	Med ($)	75° ($)	Max ($)
2700	Acute Min with Psychosl Stable and Unstable	523	614.36	1.26	47.55	162.37	300.40	686.42	3717
2800	Acute Major and Likely to Recur	16745	171.57	1.02	10.95	65.40	111.59	196.96	831
2900	Acute Min /Acute Maj / Likely to Recur, Age 1-2	3146	294.28	0.59	17.44	174.80	247.87	362.61	928
3000	Acute Minor /Acute Maj/Like to Recur, Age 2-5	7257	223.63	0.64	31.14	125.73	184.45	273.05	731
3100	Acute Min /Acute Maj/Like to Recur, Age 6-11	5887	200.12	0.69	16.64	109.27	159.33	240.99	708
3200	Acute Min /Acu Maj/Like to Recur, Age>11c/oAll	33477	260.44	0.80	15.85	123.66	193.37	316.90	1055
3300	Acute Min /Acute Maj/Like to Recur, Age>11 c Al	2663	269.67	0.70	45.89	140.52	217.67	336.13	976
3400	Acute Min / Likely to Recur / Eye & Dental	4631	188.11	0.73	16.64	101.57	147.70	226.30	764
3500	Acute Min / Likely to Recur / Psychosl	8594	283.12	1.13	34.88	117.55	183.66	306.05	1894
3600	Acute Min / Acute Maj /Like to Recur / Eye&Dent	16513	434.74	0.73	15.85	215.49	333.22	544.11	1545
3700	Acute Min / Acute Maj /Like to Recur / Eye&Dent	9963	452.01	0.92	23.61	205.38	313.94	523.52	2249
3800	2-3 Oth ADG Comb, Age < 17	15228	138.36	0.84	15.29	67.93	104.51	164.58	706
3900	2-3 Oth ADG Comb, Males Age 17-34	9927	169.94	1.24	12.01	62.29	101.54	176.39	1260
4000	2-3 Oth ADG Comb, Females Age 17-34	10384	179.73	1.05	6.97	79.61	123.67	200.61	1224
4100	2-3 Oth ADG Comb, Age > 34	85861	231.10	0.99	4.57	93.40	159.47	268.62	1199
4210	4-5 Oth ADG Comb, Age < 17, no major ADGs	8901	240.94	0.62	16.83	140.30	200.89	292.92	865
4220	4-5 Oth ADG Comb, Age < 17, 1+ major ADGs	3067	312.86	0.91	48.34	144.60	217.67	358.14	1642
4310	4-5 Oth ADG Comb, Age 17-44, no major ADGs	16259	274.34	0.80	14.64	142.32	209.16	320.72	1365
4320	4-5 Oth ADG Comb, Age 17-44, 1 major ADGs	10829	362.04	0.92	17.44	159.86	249.47	418.54	1816
4330	4-5 Oth ADG Comb, Age 17-44, 2+ major ADGs	2614	573.92	1.05	15.69	196.76	342.82	703.56	2829
4410	4-5 Oth ADG Comb, Age > 44, no major ADGs	22563	332.73	0.74	16.83	175.26	259.40	391.74	1304
4420	4-5 Oth ADG Comb, Age > 44, 1 major ADGs	25910	440.00	0.82	15.39	206.39	317.93	527.24	1748
4430	4-5 Oth ADG Comb, Age > 44, 2+ major ADGs	11606	676.46	0.91	7.48	267.87	455.05	863.39	2936
4510	6-9 Oth ADG Comb, Age < 6, no major ADGs	1509	426.10	0.51	83.40	273.14	376.35	512.63	1176
4520	6-9 Oth ADG Comb, Age < 6, 1+ major ADGs	773	639.51	0.84	115.11	309.12	447.93	779.78	2809
4610	6-9 Oth ADG Comb, Age 6-16, no major ADGs	1553	388.10	0.74	92.30	224.04	309.60	449.38	2112
4620	6-9 Oth ADG Comb, Age 6-16, 1+ major ADGs	989	622.58	0.96	69.15	269.20	409.20	709.09	3143
4710	6-9 Oth ADG Comb, Male Age 17-34,0 maj ADG	700	400.97	0.69	97.50	220.31	310.53	489.60	1741
4720	6-9 Oth ADG Comb, Male Age 17-34,1 maj ADG	1298	525.01	0.82	94.54	263.56	383.32	627.77	2364
4730	6-9 Oth ADG Comb, Male Age 17-34,2+majADG	957	888.30	1.02	113.17	324.05	563.18	1087.09	4711
4810	6-9 Oth ADG Comb, FemalAge17-34,0majADGs	2988	435.86	0.70	83.20	252.04	342.80	508.57	1812
4820	6-9 Oth ADG Comb, FemalAge17-34,1majADGs	2612	541.33	0.73	94.50	282.80	421.42	657.15	2218
4830	6-9 Oth ADG Comb,FemalAge17-34,2+majADG	980	873.30	0.92	73.53	359.42	601.45	1062.21	3996
4910	6-9 Oth ADG Comb, Age > 34, 0-1 major ADGs	32919	608.78	0.70	11.55	318.85	477.30	755.46	2172
4920	6-9 Oth ADG Comb, Age > 34, 2 major ADGs	14564	899.68	0.75	11.55	422.14	689.40	1157.31	3439
4930	6-9 Oth ADG Comb, Age > 34, 3 major ADGs	6284	1309.42	0.77	15.72	589.55	1019.61	1685.39	4707
4940	6-9 Oth ADG Comb, Age > 34, 4+ major ADGs	2121	1954.63	0.78	20.79	851.90	1499.99	2590.50	6717
5010	10+ Oth ADG Comb, Age 1-16, no major ADGs	78	961.83	0.81	270.92	486.33	717.06	1131.01	4445
5020	10+ Oth ADG Comb, Age 1-16, 1 major ADGs	90	1128.58	0.64	250.69	546.10	888.29	1548.35	3410
5030	10+ Oth ADG Comb, Age 1-16, 2+ major ADGs	82	2749.79	0.73	378.31	1310.13	2225.68	3799.65	9319
5040	10+ Oth ADG Comb, Age > 16, 0-1 major ADGs	2864	977.97	0.54	39.86	586.95	824.55	1209.86	3107
5050	10+ Oth ADG Comb, Age > 16, 2 major ADGs	3034	1291.97	0.61	197.94	732.53	1090.82	1620.73	3979
5060	10+ Oth ADG Comb, Age > 16, 3 major ADGs	2387	1710.88	0.65	190.62	927.98	1418.67	2167.86	5514

ACG	Description	n	Mean ($)	cv ($)	Min ($)	25° ($)	Med ($)	75° ($)	Max ($)
5070	10+ Oth ADG Comb, Age > 16, 4+ major ADGs	2312	2579.88	0.64	38.22	1386.73	2121.22	3259.83	7792
5110	No Diagnosis or Only Unclassified Diagnoses	77	120.90	0.91	15.80	28.00	101.92	173.46	546
5311	Infants: 0-5 ADGs, no maj ADG, low birth wgt	246	205.76	0.66	15.85	124.95	178.77	268.00	790
5312	Infants: 0-5 ADGs, no maj ADG, norm brth wgt	11959	170.71	0.58	10.45	100.80	150.75	218.32	551
5321	Infants: 0-5 ADGs, 1+ maj ADG, low birth wgt	234	355.62	0.67	34.27	192.38	304.86	443.15	1215
5322	Infants: 0-5 ADGs, 1+ maj ADG, norm brth wgt	1385	262.91	0.80	15.85	138.23	209.41	309.75	1132
5331	Infants: 6+ ADGs, no maj ADG, low birth wgt	21	460.10	0.63	159.69	304.60	400.90	491.62	1269
5332	Infants: 6+ ADGs, no maj ADG, norm brth wgt	717	434.08	0.48	109.80	300.25	387.06	506.06	1321
5341	Infants: 6+ ADGs, 1+ maj ADG, low birth wgt	143	945.17	0.82	105.25	409.52	695.85	1216.50	4070
5342	Infants: 6+ ADGs, 1+ maj ADG, norm brth wgt	583	669.05	0.89	59.71	320.97	454.65	735.68	3051
	All ACGs	937940	237.98	1.61	1.83	52.64	121.48	260.31	9319

Mean=mean physician cost per ACG; cv=coefficient of variation (standard deviation/mean); min=minimum value; 25=25th percentile; 50=median value;75=75th percentile; max=maximum value.

* includes payments for physician interviews and examinations, procedures, non-hospital laboratory and diagnostic imaging services. Individual costs greater than three standard deviations (SD) above the ACG specific mean were set equal to (Trimmed) the mean + 3 SD.

Table A4: Distribution of Total Expenditures (Outliers Trimmed)* by ACG Category, Manitoba 1995/96

ACG	*Description*	*n*	*Mean ($)*	*Cv ($)*	*Min ($)*	*25° ($)*	*Med ($)*	*75° ($)*	*Max ($)*
100	Acute Minor Age 1-2	2210	111.15	1.04	15.29	52.92	87.99	125.68	774
200	Acute Minor Age 3-5	13172	70.98	1.04	15.00	31.94	53.89	87.22	627
300	Acute Minor Age 6+	127612	61.84	1.33	6.97	16.64	36.04	70.92	665
400	Acute Major	34351	173.36	3.38	6.97	17.44	49.35	97.69	6581
500	Likely to Recur, without Allergies	44101	88.62	2.01	6.97	16.64	37.35	77.41	1225
600	Likely to Recur, with Allergies	2620	86.04	1.59	10.00	17.44	48.37	90.27	841
700	Asthma	3490	62.84	1.59	11.19	16.64	34.27	65.04	732
800	Chronic Medical, Unstable	6592	747.60	3.89	10.81	40.10	90.03	193.95	23756
900	Chronic Medical, Stable	23983	96.01	1.33	10.81	32.70	65.98	119.85	1451
1000	Chronic Specialty, Stable	1086	67.07	1.90	15.05	16.64	34.27	66.14	840
1100	Ophthalmological / Dental	8308	93.28	2.19	8.62	29.35	29.35	60.80	1123
1200	Chronic Specialty, Unstable	3107	94.07	3.36	11.76	23.05	45.20	76.25	8685
1300	Psychosl, without Psychosl Unstable	7686	161.19	2.80	10.81	16.64	48.18	109.00	3887
1400	Psychosl, c/ Psychosl Unstab, c/o Psychosl,Stab	1250	1320.90	3.72	13.86	34.27	100.93	311.30	32319
1500	Psychosl, with Psychosl Unstab, c Psychosl Stab	528	2335.72	2.40	30.58	144.93	337.24	1111.71	31399
1600	Preventive / Administrative	26898	54.42	1.52	3.09	32.71	37.35	56.30	2303
1711	Pregnancy: 0-1 ADGs, delivered	1352	1756.27	0.49	531.56	1227.14	1513.43	2026.68	5715
1712	Pregnancy: 0-1 ADGs, not delivered	427	129.37	1.25	15.25	47.96	86.59	149.42	1000
1721	Pregnancy: 2-3 ADGs, no maj ADG, delivered	4967	1967.22	0.44	436.85	1328.82	1843.49	2419.63	5429
1722	Pregnancy: 2-3 ADGs, no maj ADG, not delivered	2037	262.01	1.05	31.70	117.49	173.82	277.12	1556
1731	Pregnancy: 2-3 ADGs, 1+ maj ADG, delivered	890	2391.29	0.52	454.29	1473.22	2044.52	2957.32	7434
1732	Pregnancy: 2-3 ADGs, 1+ maj ADG, not delivered	189	774.89	0.97	35.47	202.80	565.83	1106.41	3316
1741	Pregnancy: 4-5 ADGs, no maj ADG, delivered	3153	2283.37	0.48	439.17	1474.39	2013.44	2710.59	6649
1742	Pregnancy: 4-5 ADGs, no maj ADG, not delivered	1918	471.40	0.93	65.40	198.28	289.75	629.61	2275
1751	Pregnancy: 4-5 ADGs, 1+ maj ADG, delivered	1587	2907.03	0.64	657.09	1784.79	2469.88	3328.97	11293
1752	Pregnancy: 4-5 ADGs, 1+ maj ADG, not delivered	607	1137.68	1.06	70.85	295.86	848.65	1307.10	6203
1761	Pregnancy: 6+ ADGs, no maj ADG, delivered	1460	2688.74	0.51	730.47	1698.53	2364.57	3239.10	7701
1762	Pregnancy: 6+ ADGs, no maj ADG, not delivered	1294	739.16	0.83	112.40	327.55	554.71	899.04	3153
1771	Pregnancy: 6+ ADGs, 1+ maj ADG, delivered	1922	3930.63	0.72	698.21	2204.22	3134.74	4582.83	16579
1772	Pregnancy: 6+ ADGs, 1+ maj ADG, not delivered	1339	1817.38	1.24	149.70	649.33	1134.31	1937.38	14802
1800	Acute Minor and Acute Major	52825	270.05	2.37	6.97	65.98	108.99	186.68	5844
1900	Acute Minor and Likely to Recur, Age 1-2	5337	244.67	1.20	30.58	114.04	166.42	247.11	2037
2000	Acute Minor and Likely to Recur, Age 3-5	15574	166.23	1.09	16.64	75.05	114.57	176.13	1025
2100	Acute Minor and Like to Recur, Age >5, c/o All.	61059	165.77	1.35	6.97	59.20	96.29	160.64	1283
2200	Acute Minor and Likely to Recur, Age >5, c All.	5238	173.82	1.16	24.60	66.00	113.85	184.95	1029
2300	Acute Minor and Chronic Medical: Stable	22153	163.61	1.17	15.85	69.15	117.33	189.37	1668
2400	Acute Minor and Eye / Dental	6968	156.49	1.43	28.61	54.85	84.07	139.31	1201
2500	Acute Min with Psychosl Stab c/o Psychosl Unst	9476	210.41	1.76	15.85	63.40	107.43	191.07	2900
2600	Acute Min c/o Psychosl Stab c Psychosl Unstab	814	948.65	3.15	30.58	83.16	160.34	366.50	19257
2700	Acute Min with Psychosl Stable and Unstable	523	1833.56	2.23	47.55	176.30	395.36	1140.02	21882
2800	Acute Major and Likely to Recur	16758	355.85	2.06	15.85	66.20	116.54	240.95	4998

ACG Description	n	Mean ($)	Cv ($)	Min ($)	25° ($)	Med ($)	75° ($)	Max ($)
2900 Acute Min /Acute Maj / Likely to Recur, Age 1-2	3146	653.52	1.55	47.55	181.67	273.77	534.44	5436
3000 Acute Minor /Acute Maj/Like to Recur, Age 2-5	7257	349.19	1.38	38.58	127.47	191.26	303.48	2910
3100 Acute Min /Acute Maj/Like to Recur, Age 6-11	5887	319.20	1.48	34.70	110.61	164.92	263.64	2914
3200 Acute Min /Acu Maj/Like to Recur, Age>11c/oAll	33482	494.38	1.61	15.85	127.20	210.04	466.38	4854
3300 Acute Min /Acute Maj/Like to Recur, Age>11 c A	2663	394.23	1.21	45.89	142.58	227.00	397.21	2555
3400 Acute Min / Likely to Recur / Eye & Dental	4631	269.38	1.14	16.64	104.40	157.95	262.05	1559
3500 Acute Min / Likely to Recur / Psychosl	8595	456.89	2.22	46.43	119.43	193.48	363.93	9481
3600 Acute Min / Acute Maj /Like to Recur / Eye&Dent	16513	1012.95	1.62	16.64	232.07	411.59	955.59	10194
3700 Acute Min / Acute Maj /Like to Recur / Eye&Dent	9963	1008.38	2.09	23.61	220.03	382.85	843.03	17612
3800 2-3 Oth ADG Comb, Age < 17	15231	249.12	2.29	27.93	69.40	107.94	178.68	5482
3900 2-3 Oth ADG Comb, Males Age 17-34	9933	372.81	2.72	15.85	62.85	105.10	199.32	9100
4000 2-3 Oth ADG Comb, Females Age 17-34	10394	300.12	2.10	6.97	81.15	127.93	220.96	5537
4100 2-3 Oth ADG Comb, Age > 34	85949	626.92	3.15	6.97	95.74	167.26	312.63	17632
4210 4-5 Oth ADG Comb, Age < 17, no major ADGs	8901	440.14	1.64	33.28	144.55	213.04	347.97	5278
4220 4-5 Oth ADG Comb, Age < 17, 1+ major ADGs	3068	814.01	2.13	48.34	148.03	230.40	610.65	11328
4310 4-5 Oth ADG Comb, Age 17-44, no major ADGs	16261	400.02	1.23	14.64	146.72	221.52	400.69	2757
4320 4-5 Oth ADG Comb, Age 17-44, 1 major ADGs	10831	792.08	1.93	32.70	167.07	282.55	680.98	12410
4330 4-5 Oth ADG Comb, Age 17-44, 2+ major ADGs	2616	2270.81	1.78	61.16	230.63	583.39	2372.19	22326
4410 4-5 Oth ADG Comb, Age > 44, no major ADGs	22564	524.81	1.45	40.85	181.68	277.95	483.98	4974
4420 4-5 Oth ADG Comb, Age > 44, 1 major ADGs	25922	1289.77	2.20	15.39	222.62	378.59	885.96	19839
4430 4-5 Oth ADG Comb, Age > 44, 2+ major ADGs	11627	5299.61	1.89	62.84	354.03	1265.27	5383.36	53906
4510 6-9 Oth ADG Comb, Age < 6, no major ADGs	1509	1103.53	1.59	102.84	294.16	450.29	1088.57	10174
4520 6-9 Oth ADG Comb, Age < 6, 1+ major ADGs	773	3450.67	2.23	115.11	331.68	754.56	2375.10	47785
4610 6-9 Oth ADG Comb, Age 6-16, no major ADGs	1553	711.37	1.86	92.30	231.63	334.73	574.33	11748
4620 6-9 Oth ADG Comb, Age 6-16, 1+ major ADGs	989	2394.22	2.11	97.35	297.42	582.52	1772.45	26978
4710 6-9 Oth ADG Comb, Male Age 17-34,0 Maj ADG	701	604.09	1.88	97.50	231.22	335.45	596.53	22985
4720 6-9 Oth ADG Comb, Male Age 17-34,1 Maj ADG	1298	1053.90	1.51	94.54	285.32	477.33	1069.35	8747
4730 6-9 Oth ADG Comb, Male Age 17-34,2+majADG	957	5175.56	2.27	113.17	408.17	1157.78	3825.74	72264
4810 6-9 Oth ADG Comb, FemalAge17-34,0majADGs	2988	662.24	1.04	93.98	264.68	398.80	751.74	3655
4820 6-9 Oth ADG Comb, FemalAge17-34,1majADGs	2612	1101.85	1.43	94.50	307.51	529.83	1188.33	9808
4830 6-9 Oth ADG Comb,FemalAge17-34,2+majADG	980	3615.65	1.82	73.53	513.22	1220.07	3317.87	36665
4910 6-9 Oth ADG Comb, Age > 34, 0-1 major ADGs	32920	1464.37	1.70	92.41	352.65	602.80	1308.64	15592
4920 6-9 Oth ADG Comb, Age > 34, 2 major ADGs	14571	5185.40	1.72	49.92	587.07	1561.71	5504.86	48063
4930 6-9 Oth ADG Comb, Age > 34, 3 major ADGs	6288	11307.51	1.31	68.18	1790.94	5828.66	14341.07	71948
4940 6-9 Oth ADG Comb, Age > 34, 4+ major ADGs	2126	20958.96	1.09	166.32	5936.56	13726.48	25895.25	109533
5010 10+ Oth ADG Comb, Age 1-16, no major ADGs	78	3978.53	1.77	270.92	606.40	1207.38	3452.40	34624
5020 10+ Oth ADG Comb, Age 1-16, 1 major ADGs	90	6873.31	1.64	250.69	649.61	1697.44	9836.77	59292
5030 10+ Oth ADG Comb, Age 1-16, 2+ major ADGs	82	33702.52	1.19	378.31	5914.61	19814.51	48116.35	185329
5040 10+ Oth ADG Comb, Age > 16, 0-1 major ADGs	2864	2193.26	1.38	218.45	702.60	1149.31	2301.66	18862
5050 10+ Oth ADG Comb, Age > 16, 2 major ADGs	3034	5468.23	1.46	197.94	1039.08	2234.70	5995.84	40670
5060 10+ Oth ADG Comb, Age > 16, 3 major ADGs	2387	12199.92	1.31	236.68	2078.53	6205.46	15019.77	79752
5070 10+ Oth ADG Comb, Age > 16, 4+ major ADGs	2312	24122.13	0.97	309.59	7515.80	16605.96	32213.36	104669
5110 No Diagnosis or Only Unclassified Diagnoses	86	256.87	1.72	15.80	42.57	114.70	207.15	2186

ACG Description	n	Mean ($)	Cv ($)	Min ($)	25° ($)	Med ($)	75° ($)	Max ($)
5311 Infants: 0-5 ADGs, no maj ADG, low birth wgt	261	1724.81	0.88	307.25	762.01	1181.16	1904.15	7141
5312 Infants: 0-5 ADGs, no maj ADG, norm brth wgt	12123	717.05	0.64	15.85	476.65	592.80	820.38	2689
5321 Infants: 0-5 ADGs, 1+ maj ADG, low birth wgt	244	5232.81	0.85	371.80	1654.52	3892.46	7813.52	19633
5322 Infants: 0-5 ADGs, 1+ maj ADG, norm brth wgt	1403	1612.02	1.07	88.50	669.65	974.62	1785.35	10379
5331 Infants: 6+ ADGs, no maj ADG, low birth wgt	21	2721.43	0.91	534.15	1124.85	1618.54	4231.72	10450
5332 Infants: 6+ ADGs, no maj ADG, norm brth wgt	717	1728.05	0.99	376.99	779.50	1069.15	1908.68	9373
5341 Infants: 6+ ADGs, 1+ maj ADG, low birth wgt	143	11994.90	0.84	750.25	4048.90	8137.00	17618.72	46437
5342 Infants: 6+ ADGs, 1+ maj ADG, norm brth wgt	583	5343.43	1.35	260.99	1258.46	2315.32	5751.53	31997
All ACGs	938988	817.62	4.52	3.09	53.55	128.53	345.21	185329

Mean=mean cost per ACG; cv=coefficient of variation (standard deviation/mean); min=minimum value; 25° =25th percentile; 50° =median value;75° =75th percentile; max=maximum value.

* expenditures include physician expenditures (interview, procedure, non-hospital laboratory & diagnostic imaging payments) and hospital expenditures (see Appendix A).

Individual costs greater than three standard deviations (SD) from the ACG specific mean cost have been set equal to the mean + 3 SD.

REFERENCES

Ash A., Ellis W, Yu W. Risk adjustment in the non-elderly. Cooperative agreement number 18-C-90462/1-02 for the Health Care Financing Administration. 1997. Boston MA, Boston University and Health Economics Research.

B.C.Ministry of Health and Ministry Responsible for Seniors. *Primary Care Demonstration Project: Policy and Information Guide*. http://www.hlth.gov.bc.ca/care/primdemo/. 4-13-2000.

Black CD, Roos NP, Burchill C. 1995. Utilization of Hospital Resources. *Med Care* 33(12):DS55-DS72.

Briggs, LW, JE, Rohrer, RL Ludke, PE Hilsenrath. Geographic Variation in Primary Care Visits in Iowa. *Health Serv Res* 1995 30(5):657-671.

British Columbia Medical Services Plan. *A Guide to the Interpretation of the Medical Services Plan Practitioner Profiles*. Victoria BC, BC Ministry of Health and Ministry Responsible for Seniors; 2000.

Canadian Institute for Health Information. *Day Procedure Groups*. Ottawa, ON, Canadian Institute for Health Information; 1994.

Canadian Institute for Health Information. *Resource Intensity Weights*. Ottawa, ON, Canadian Institute for Health Information; 1994.

Canadian Medical Association. *Strengthening the Foundation: the Role of the Physician in Primary Health Care in Canada*. 1-20. Ottawa, ON, Canadian Medial Association; 1994.

Carstairs V. Deprivation Indices: Their Interpretation and Use in Relation to Health. *J Epidemiol Community Health* 1995;49 Suppl (2):S3-S8.

Carstairs V. Morris R. 1989. Deprivation, Mortality and Resource Allocation. *Community Med* 1989;11(4): 64-372.

Carter G, Newhouse JP, Relles DA. How Much Change in the Case-Mix Index Is DRG Creep? *J Health Econ* 1990;9(4):411-428.

Commission d'étude sur les Services de Santé et les Services Sociaux. *Consultation publique sur le financement et l'organisation des services de santé et des services sociaux*. Québec, Gouvernement du Québec; 2000.

Eyles J Birch S. A Population Needs-Based Approach to Health-Care Resource Allocation and Planning in Ontario: a Link Between Policy Goals and Practice? *Can J Public Health*. 1993;84(2):112-117.

Eyles J, Birch S, Chambers S, Hurley J, Hutchison B. A Needs-Based Methodology for Allocating Health Care Resources in Ontario, Canada: Development and an Application. *Soc Sci Med* 1991;33(4):489-500.

Federal/Provincial/Territorial Advisory Committee on Health Services. *The Victoria report on physician remuneration: a model for the reorganization of primary care and the introduction of population-based funding (the Kilshaw Report).* Victoria, BC, Queen's Printer of British Columbia; 1995.

Fowles J, Weiner JP, Knudson D, Fowler E, Tucker AM, Ireland M. Taking Health Status into Account When Setting Capitation Rates: a Comparison of Risk-Adjustment Methods. *JAMA* 1996;276(16): 316-1321.

Frohlich N. Carriere KC. *Issues in Developing Indicators for Needs-based Funding*. Winnipeg, MB, Manitoba Centre for Health Policy and Evaluation; 1997.

Green B, Barlow J, Newman C. Ambulatory Care Groups and the Profiling of Primary Care Physician Resource Use: Examining the Application of Case-Mix Adjustments. *J Ambulatory Care Manage* 1997;19(1):90-97.

Hendryx MS, Wakefield DS, Murray JF, Uden-Holman T, Helms CM, Ludke RL. Using Comparative Clinical and Economic Outcome Information to Profile Physician Performance. *Health Serv Manage Res* 1995;8(4):213-220.

Hurley J, Hutchison B, Giacomini M., Birch S, Dorland,J, Reid R, Pizzoferrato G. *Policy considerations in implementing capitation for integrated health systems*. Ottawa, ON, Canadian Health Services Research Foundation; 1999.

Hutchison B, Hurley J, Reid R, Dorland J, Birch S, Giacomini M, Pizzoferrato, G. *Capitation formulae for integrated health systems. A policy synthesis*. Ottawa, ON, Canadian Health Services Research Foundation; 1999.

Hutchison B, Hurley J, Birch S, Lomas J, Walter SD, Eyles J, Stratford-Devai F. Needs-Based Primary Medical Care Capitation: Development and Evaluation of Alternative Approaches. *Health Care Manage Sci* 2000;3(2):89-99.

Iezzoni LI. *Risk Adjustment for Measuring Health Care Outcomes*, Ann Arbor, MI: Health Administration Press; 1994.

Institute of Medicine. Defining Primary Care, in *Primary Care: America's Health in a New Era*, ed. Donaldson MS et al., vol. 2, Washington, DC: National Academy Press, 1996;27-51.

Jacobs P, Shanahan M., Roos N, Farnsworth M. *Cost List for Manitoba Health Services*. Manitoba Centre for Health Policy and Evaluation, Winnipeg, MB; 1999.

The Johns Hopkins University. *ACG Case-Mix Adjustment System*, Ver. 4.0, Johns Hopkins University; 2000.

Kasper JD. The Importance of Type and Usual Source of Care for Children's Physician Access and Expenditures. *Med Care* 1987;25(5): 86-398.

Kazanjian A, Reid RJ, Pagliccia N, Apland L, Wood L. Issues in Physician Resource Planning in BC: Key Determinants of Supply and Distribution 1991-96. Centre for Health Services and Policy Research. Vancouver, BC; 2000.

Krentz SE, Miller TR. Physician Resource Profiling Enhances Utilization Management. *Healthcare Finance Manage* 1998;52(10):45-47.

Kronick RT, Dreyfus LL, Zhou A. Diagnostic Risk Adjustment for Medicaid: The Disability Payment System. *Health Care Finance Rev* 1996;17(3):7-33.

Lasker RD, Shapiro DW, Tucker AM. Realizing the Potential of Practice Pattern Profiling. *Inquiry* 1992;29(3):287-297.

Menec V, Black C, Roos NP, Bogdanovic B, Reid RJ. *Defining Practice Populations for Primary Care: Methods and Issues*. Manitoba Centre for Health Policy and Evaluation. Winnipeg, MB; 2000.

Mooney G. What Does Equity in Health Mean? *Wld Hlth Stat Q* 1987;40:296.

Ontario College of Family Physicians. *Family Medicine in the 21st Century: A Prescription for Excellent Health Care*. Ontario College of Family Physicians. Ottawa, ON; 1999.

Ontario Health Services Restructuring Commission. *Looking Back, Looking Forward: A Legacy Report of the Ontario* Health Services Restructuring Commission. Ontario Health Services Restructuring Commission. Toronto, ON; 2000.

Ontario Medical Association. *Primary Care Reform: A Strategy for Stability*. Ontario Medical Association. Toronto, ON; 1997.

Parente ST, Weiner J, Garnick DW, Fowles J, Lawthers AG, Palmer RH. Profiling Resource Use by Primary Care Practices: Managed Medicare Applications. *Health Care Finance Rev* 1996;17(4):23-42.

Pope GC. *Diagnosis-based risk adjustment for Medicare capitation payments*. Presentation at American Public Health Association Annual Meeting 1996, Health Economics Research, Inc; 1997.

Provincial Coordinating Committee on Community and Academic Health Science Centre Relations. *New Directions in Primary Healthcare*. Ontario Ministry of Health. Toronto, ON; 1996.

Reid RJ, MacWilliam L, Roos NP, Bogdanovic, B, Black C. *Measuring Morbidity in Populations: Performance of the Johns Hopkins Adjusted Clinical Group (ACG) Case-Mix Adjustment System in Manitoba*. Manitoba Centre for Health Policy and Evaluation. Winnipeg, MB; 1999.

Reid RJ, MacWilliam L, Verhulst L, Roos NP, Atkinson M. Performance of the ACG Case-Mix System in two Canadian provinces. *Med Care* 2001a;36(1):86-99.

Reid RJ, Roos NP, MacWilliam L, Frohlich N, Black C. *Assessing Population Need Using a Claims-Based ACG Morbidity Measure: A Validation Analysis in the Province of Manitoba*. Winnipeg, MB; 2001b.

Roblin DW. Applications of Physician Profiling in the Management of Primary Care Panels. *J Ambulatory Care Manage* 1996;19(2):59-74.

Roos NP, Fransoo R, Bogdanovic B, Carriere KC, Frohlich N, Friesen D, Patton D, Wall R. *Needs-Based Planning for Generalist Physicians*. *Med Care* 1999b;37(6) Suppl: JS206-JS228.

Roos NP, Fransoo R, Bogdanovic B, Friesen D, MacWilliam, L. *Issues in Planning for Specialist Physicians*. *Med Care* 1999a;37,(6) Suppl: JS229-JS253.

Roos NP, Fransoo R, Bogdanovic B, Friesen D, Frohlich N, Carriere KC, Patton D, Wall, R. *Needs-based Planning for Manitoba's Generalist Physicians*. Manitoba Centre for Health Policy and Evaluation. Winnipeg, MB; 1996.

Roos NP, Mustard CA. Variation in health and health care use by socioeconomic status in Winnipeg, Canada: Does the system work well? Yes and no. *Milbank Q* 1997;75(1):89-111.

Salem-Schatz S, Moore G, Rucker M, Pearson SD. The case for case-mix adjustment in practice profiling. *JAMA* 1994;272(11):871-874.

Shanahan M, Loyd M, Roos NP, Brownell M. A comparative study of the costliness of Manitoba hospitals. *Med Care* 1999;37(6) (Suppl): JS101-JS122.

Shanahan M. *Hospital Case Mix Costing Project 1993/94*. Manitoba Centre for Health Policy and Evaluation. Winnipeg, MB; 1996.

Shanahan M, Loyd M, Roos NP, Brownell M. *Hospital Case Mix Costing Project 1991/92*. Manitoba Centre for Health Policy and Evaluation. Winnipeg, MB; 1994.

Shanahan M, Steinbach C, Burchill C, Friesen D, Black C. *A Project to Investigate Provincial Expenditures on Health Care to Manitobans*. Manitoba Centre for Health Policy and Evaluation. Winnipeg, MB; 1997.

Starfield B. Is Primary Care Essential? *Lancet* 1994;344(8930):1129-1133.

Starfield B. “Morbidity in Primary Care,” in *Primary Care: Balancing Health Needs, Services and Technology*, New York: Oxford University Press. New York; 1998.

Starfield B, Powe NR, Weiner J, Stuart ME, Steinwachs D, Scholle S, Gerstenberger A. Costs versus quality in different types of primary care settings. *JAMA* 1994;272:1903-1908.

Starfield B, Weiner J, Mumford L, Steinwachs D. Ambulatory Care Groups: a Categorization of Diagnoses for Research and Management. *Health Serv Res* 1991;26(1):53-74.

Tataryn DJ, Roos NP, Black CD. Utilization of Physician Resources for Ambulatory Care. *Med Care* 1995;33, 12 Suppl: DS84-DS99.

Tucker AM, Weiner J, Honigfeld S, Parton RA. Profiling Primary Care Physician Resource Use: Examining the Application of Case Mix Adjustment. *J Ambulatory Care Manage* 1996;19(1):60-80.

US General Accounting Office. *A Health Status Indicator for Targeting Federal Aid to States*. GAO/HEHS-97-13, 1-26. US General Accounting Office. Washington, DC; 1996.

Weiner J, Dobson A., Maxwell S, Coleman K, Starfield B, Anderson G. Risk-adjusted Medicare capitation rates using ambulatory and inpatient diagnoses. *Health Care Financing Rev* 1996;17(3):77-99.

Weiner JS, Parente T, Garnick DW, Fowles J, Lawthers AG, Palmer RH. Variation in office-based quality. A claims-based profile of care provided to medicare patients with diabetes. *JAMA* 1995;273,(19):1534-1537.

Weiner J, Starfield B, Powe NR, Stuart ME, Steinwachs D. Ambulatory care practice variation within a Medicaid program. *Health Serv Res* 1996a;30(6):752-770.

Weiner J, Starfield B, Steinwachs D, Mumford L. Development and application of a population-oriented measure of ambulatory care case-mix. *Med Care* 1991;29(5):452-472.

Weiner J Tucker AM, Collins AM, et al. The development of a risk-adjusted capitation payment system for Medicaid MCOs: The Maryland Model. *J Ambulatory Care Manage* 1998;21:29-52.

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