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# DEVELOPMENT AND APPLICATION OF A NEEDS-BASED METHODOLOGY FOR CALCULATING A CAPITATION RATE FOR A COMPREHENSIVE HEALTH ORGANIZATION

Stephen Birch
Shelley Chambers
John Eyles
Jeremiah Hurley
Brian Hutchison

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# DEVELOPMENT AND APPLICATION OF A NEEDS-BASED METHODOLOGY FOR CALCULATING A CAPITATION RATE FOR A COMPREHENSIVE HEALTH ORGANIZATION

Stephen Birch D. Phil[1, 2]
Shelley Chambers M.A.[1]
John Eyles Ph.D.[2,3]
Jeremiah Hurley Ph.D.[1,2]
Brian Hutchison M.D., M.Sc. CCFP[2,4]

McMaster University, Hamilton, Ontario

[1] Department of Clinical Epidemiology and Biostatistics
[2] Centre for Health Economics and Policy Analysis
[3] Department of Geography
[4] Department of Family Medicine

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**Executive summary**

In this study we develop a methodology for calculating a capitation rate for a Comprehensive Health Organization (CHO). We apply the methodology to the population served by the proposed Fort Frances CHO.

The methods of calculating capitation rates used currently by the Ontario Ministry of Health to determine funding levels of Health Service Organizations (HSOs), as well as the methods proposed for calculating CHO capitation rates, are critically reviewed. Both approaches base the calculated capitation rates on the current, or past, levels of health-care utilization, which perpetuate any existing inequalities in access to health care in the province.

The methodology developed in this study has the health-care needs of the study population, as distinct from the health-care use of patients, as its focus. We argue that this needs-based approach is consistent with the philosophy of the Canada Health Act (1984) and encompasses aspects of both efficiency and equity in the allocation of health-care resources.

Studies on population characteristics which correlate with health status and risks to health are reviewed, as is the literature on population-based planning of health-care resources. The strengths and weaknesses of potential indicators of health-care needs are evaluated. A profile of the study population is constructed, using data from the national census and other sources, which is compared with a corresponding profile of the provincial population. Particular features of the study population are identified as factors giving rise to atypical levels of need for health care. On the basis of the literature review, the standardized mortality ratio (SMR) is used as the best available indicator of need for most programmes.

A capitation rate for a CHO serving the study population is calculated using this information on population characteristics. For each health-care programme to be covered by the CHO, the provincial mean per-capita utilization rate is calculated and subjected to three adjustments; one to reflect the demographic mix of the study population (age and gender-adjusted capitation rate); one to reflect the particular needs of the study population after adjusting for age and gender (needs-adjusted capitation rate); and one to reflect the costs of providing services for a given level of need in the study population (cost-adjusted capitation rate). For each programme, appropriate (age and gender-adjusted, needs-adjusted and cost-adjusted) shares of provincial programme expenditure for the study population are calculated. These shares are then expressed in dollars per-capita population to produce population-specific capitation rates. A major feature of the methodology is that the study population's current use of health-care services does not enter into the calculation.

Wherever assumptions are made because of either the absence of data, or the need for further research, we attempt to choose values of variables which produce conservative capitation rates. Based on this methodology the global (all programme) capitation rate for the CHO in Fort Frances is $1363.13 (age and gender-adjusted), $1655.90 (needs-adjusted) and $1772.28 (cost-adjusted) with an additional $50.30 (for each rate) to cover programmes not currently funded by the Ministry of Health (child and family intervention, child mental illness, residential homes for developmentally handicapped and residential counselling). These calculations are found to be fairly robust to the use of alternative needs indicators.

As far as we are aware, this study represents the first attempt to apply a population-needs approach to the allocation of an entire, comprehensive range of health-care services. Information on the study population's current use of health-care programmes, where available, is compared to the calculated needs of the population for these services. On the basis of these comparisons, considerable differences are observed between use of and need for services in the study population.

# Section 1: Introduction

## 1.1 Research question

The purpose of this research is to calculate a capitation rate for a Comprehensive Health Organization (CHO) that will provide health-care services to the population of Fort Frances, Ontario, and the surrounding areas. A CHO has been defined as "... a non-profit corporation which assumes responsibility for providing or purchasing the delivery of a full range of vertically integrated health and related services to a defined population" (Marriot, no date). In return for assuming this responsibility the CHO is paid a fixed annual amount for each person in the defined population.

The context for calculating the capitation rate is the current allocation of resources to health-care provision in Ontario. The research question is:

> Given the regional and population characteristics of the Fort Frances community and the surrounding areas, what is the appropriate share of Provincial health-care expenditures, based on health-care needs, that the CHO should receive for providing health-care services to this population?

The methods used to calculate the capitation rate will focus on the implications of these identified population characteristics for health risks and the need for health-care services. A major feature of this needs-based approach to planning health-care resources is that current health-care use by the population under consideration has no direct influence on the calculation of resource needs.

## 1.2 Research objectives

The study has two main objectives:

a. To develop a needs-based methodology for calculating capitation rates for the funding of health-care services provided under a CHO.

b. To apply the methodology using available data to calculate a capitation rate for the provision of a defined set of health-care services to the geographically-defined population of Fort Frances, Emo and Rainy River and surrounding areas (see Figure 4.1 in Section 4).

Although the focus of this study is the population of Fort Frances and the surrounding areas, the methodology used to calculate the capitation rates may be applied to other defined populations. The method is intended to base the distribution of health-care resources within a jurisdiction (in this case, the province of Ontario) on the distribution of needs for health care among particular population groups and/or regions or subregions.

This represents a major change from the existing approaches to the allocation of health-care resources in Ontario under which current resource allocations are determined largely by past resource allocations and the distribution of health-care facilities and providers of health care. In particular, hospitals are funded on the basis of global budgets which are determined, by and large, by previous years' expenditures. In setting these budgets, no consideration is given to characteristics of the population being served as distinct from patient characteristics, and any existing inequalities in health-care distribution are perpetuated.

Physicians are funded largely by fee-for-service. Even where capitation payments are currently used, the capitation rate relates directly to the utilization under fee-for-service. As such, resource allocation is determined by the number and type of services provided, which are related in part to the number and type of physicians. But the distribution of physicians may or may not correspond to the distribution of population needs for health care.

The needs-based approach to health-care resource allocation incorporates aspects of both efficiency and equity. Efficiency in this context is concerned with maximizing the

health status improvements produced from a given amount of health-care resources. Under the needs-based approach, populations with greater health-care needs, and hence greater potential for health improvements, are allocated greater levels of resources. Equity, on the other hand, introduces notions of fairness into the allocation of health-care resources. The needs-based approach provides equal resources for populations with equal needs (or what is referred to as horizontal equity in economics) but unequal resources for populations with unequal needs (vertical equity in economics). Policy makers may want to go beyond allocating resources in accordance with health-care needs and to weight for other factors over and above those needs (i.e., positive discrimination), but this political, rather than technical, issue is beyond the scope of this report (see Edwards 1987).

## Section 2: Capitation in health-care provision in Ontario

## 2.1 Capitation for Health Service Organizations

Capitation is currently used in Ontario to fund physician services in Health Service Organizations (HSOs). The HSO is paid a fixed monthly capitation fee for each person the HSO identifies as being a member of its service population. The payment represents the resources obtained for providing specified services (which must include primary care) to that member, and is unrelated to the quantity, type or cost of services actually provided.

The capitation payment is set according to the mean per patient cost of physician services in the co-existing (and much larger) fee-for-service sector. Separate capitation payments are set for each gender and five-year age group.

The HSO may receive additional funds under the Ambulatory Care Incentive Plan (ACIP) which provides an incentive for providers to substitute ambulatory care for hospital-based care. Under this plan the rate of hospital utilization of the HSO members is compared to the rate of hospital utilization by the entire population of the region in which the HSO is located (with adjustments for the age and gender mix of the populations). The HSO receives one third of the mean hospital per diem cost in that community for each day of hospital care 'saved' based on the comparison of rates of hospitalization.

Several issues have been identified and discussed concerning the nature of this remuneration package for HSOs (Birch et al. 1990). For the purposes of this report, however, it is sufficient to note that:

a) the level of capitation payment is based on the level of current (or immediate past) use of health-care services in the fee-for-service sector.

b) the level of payment takes no account of the needs of the population, other than through adjustments for gender and age. (In other words a HSO receives the same fee to cover physician service provision for each person

within a specific age-group and gender category, irrespective of any other health risks and health-care needs).

c) following on from (b), the calculated capitation rate provides a generous level of resources for HSOs serving patient populations with above-average health status, because the capitation rate is not specific to the selected membership.

## 2.2 Comprehensive Health Organizations

A CHO differs from a HSO in that the CHO assumes responsibility for the entire range of patient care services, i.e., primary, secondary and tertiary care services. The principle behind this type of organization is that, unlike capitation for physician services in the HSO, it avoids an incentive to offload demands for services onto another sector (e.g., to hospitals through premature referrals), because the costs of all service utilization, including hospital costs, must be met from the capitation payment. In other words, the CHO assumes financial responsibility under the capitation rate for both services provided directly and services provided following referral.

According to the Ontario Ministry of Health (MoH), the CHO capitation rate is to be based on ".... a formula related to the health costs of the members" (Caplan 1989). This has been interpreted to mean that the rate is to be calculated by summing the health-care costs of the CHO members for the most recent years available and dividing by the number of members to produce a cost per member. This methodology differs from the approach used to set HSO capitation rates in that for the CHO, the per capita health-care costs of the defined membership, as opposed to the total population, is used to determine the capitation rate. Features of the proposed CHO approach are:

a) current use of health-care services is influenced by availability of and accessibility to health-care providers. Hence current use may differ among individuals with the same health risks and health-care needs. Consequently,

basing the capitation rate on current use, perpetuates the current distribution of health-care resources.

b) data limitations and current accounting conventions used may prevent health-care costs incurred by individuals from being identified. In the absence of such member-specific information, population-average costs may be substituted as a proxy for individual costs. The methodology for determining the CHO capitation rate then converges towards the HSO capitation methodology.

c) as with the HSO methodology, no account is taken of the relative health risks or needs for health care of the CHO membership. Indeed, in so far as the proposed CHO methodology does not standardize for age or gender on the basis of provincial costs, it could be argued that it takes less account of population-based needs than the HSO methodology.

d) patient selection on the basis of below-average needs for health-care services is not a problem if the proposed methodology is applied strictly. However where mean utilization rates are used as a proxy for individual needs, then incentives to 'select' members with below-average needs re-emerge.

Although the MoH indicates that future refinements to the capitation rate methodology will "...take into account age, sex and illness patterns of members" (Ontario Ministry of Health 1989), details of how or when this will be achieved are not given. Furthermore, consideration is not given to how the adjustments from the use-based method to the needs-based method will be made, even though this could involve large changes in financial provisions to individual CHOs.

## 2.3 Need as an alternative approach to capitation setting

In this study an alternative approach to calculating capitation rates is adopted for conceptual, managerial and pragmatic reasons. From a conceptual point of view, health-care provision in Canada is based on the philosophy of providing health-care services in accordance with health-care needs (Canada Health Act 1984). If health-care resource allocation is to be consistent with this philosophy, it should reflect the health-care needs of the population. Yet current approaches to capitation setting appear to be at odds with this philosophy, being based on existing utilization of services, which may or may not reflect variations in population health risks and health-care needs. Indeed, the use-based approach simply perpetuates any existing inequalities in levels of provision among population groups. The needs-based approach to calculating a capitation rate breaks any direct links with utilization and, as noted above, encompasses aspects of both efficiency and equity in the resulting allocation, although not necessarily the use, of health-care resources.

From a managerial point of view, a needs-based approach removes the incentive to select members with low levels of health-care needs because the capitation rate is based upon the health-care needs of the recruited membership.

From a pragmatic point of view, the particular location of the Fort Frances population severely restricts attempts to quantify existing use. In particular, a major referral centre for the Fort Frances providers is Winnipeg, Manitoba. Although the costs of the services provided on referral are charged back to the Ontario MoH, neither the Manitoba nor the Ontario administrative data sets can currently be used to identify out-of-province use of health-care services by members of the study population, or any individual or specific sub-population.

In our needs-based approach to calculating the capitation rate we shall pay attention to characteristics of the CHO population which, in previous research, have been found to correlate with health-care needs. In this way the capitation rate can be calculated in

accordance with the prevalence of factors that cause or are correlated with health-care needs.

# Section 3: Needs-based planning of health-care resources: An overview of the literature

## 3.1 Population-based indicators of health status: Findings from Canadian Studies

The Black Report (U.K. Department of Health and Social Security, 1980) highlighted relationships between morbidity, mortality and socioeconomic status that were observed in the U.K. The interest aroused by the report has led to considerable attention being paid by researchers in other countries to the socioeconomic correlates of health. Canadian studies have identified strong relationships between health variables (mortality, morbidity, self-reported health status) and various socioeconomic variables. Using data from the Canadian Health Survey, Hay (1988) found a direct positive relationship in adult non-elderly populations between health status (individual self-reports of disability days, oxygen consumption, skinfold measures) and socioeconomic factors (education, income, occupation), with the income-health correlation being the strongest. Roos and Shapiro (1981) found a similar relationship between income and self-reported health for the elderly population in Manitoba. Both the length (Wigle and Mao 1980) and the quality (Wilkins and Adams 1983) of life of the elderly have been shown to correlate well with income. More recently Wilkins (1990) observed strong negative correlations between family income and both mortality and disability in children, and Wilkins et al. (1990) showed that despite decreasing differences in mortality between income quintiles in urban Canada, relative mortality (i.e., lowest as compared to highest income groups) changed only slightly between 1971 and 1986.

Millar (1987) showed that after adjusting for age and gender, the prevalence of smoking was highest among persons with little education, while Wilkins (1988) found a positive relationship between knowledge of the health risks associated with smoking and education. Saveland and Gillieson (1982) found low education, low income levels and job interruptions and demands were all significantly associated with higher mortality risks. Specific relationships have been examined by other researchers, for example poorer health status or life expectancy has been observed among native Canadians (D'Arcy 1989), among the unemployed (D'Arcy and Siddique 1985) and in rural areas (Wilkins and Adams 1983). As Wilkins notes in reviewing these findings

> "One policy implication...is that in order to provide equivalent services for a given health need, not only age and sex but also some indicator of socioeconomic status (such as income or education) must be taken into account. Health planning based on mechanically applying the same age sex specific rates to populations of widely differing socioeconomic characteristics can result in serious underservicing of the disadvantaged, aggravating rather than to reddressing inequalities in health status (Wilkins 1987, p7)

Yet to date, there has been little, if any, attention paid in the Canadian literature or policy making to the application of a population-based approach to health-care resource allocation which takes account of observed differences in health status (or its correlates).[1]

### 3.2 Population-based planning of health care resources: Findings from U.S. studies

The U.S. literature has shown an increasing interest in identifying population-based indicators which can be used to adjust capitation rates for heterogeneous risks among members of Health Maintenance Organizations (HMOs). It should be emphasized that this literature is concerned with adjusting capitation rates to accurately reflect the predictable costs of meeting demands for care rather than need for care. Although there may be a correlation between need and demand, they are distinct concepts.

In this literature there is no overriding notion of a fixed total allocation of resources which has to be shared among members of a population. Consequently the research focuses on the prediction of the absolute levels of demand for care by individuals as opposed to the relative needs for care among populations, which is the focus of the current research.

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[1] One exception to this is the use of an income-based measure of socioeconomic status in Quebec to weight for different needs for home care services between districts of the planning authority (Secteur des services multiclienteles de premiere ligne 1989).

Notwithstanding these differences, the characteristics of an ideal weighting formula for resource allocation identified in the U.S. literature are useful in selecting needs indicators for a population needs-based formula. In particular, Anderson et al. (1986) identified the following five criteria for an ideal capitation formula:

i. the calculated per capita resources should accurately reflect the predictable health-care costs of an individual

ii. the predictable costs should vary as a function of characteristics of the persons being enrolled in the capitation-based system

iii. the derived formula should be capable of being used for all participants

iv. the data collection and processing requirements should be administratively feasible

v. the formula should be resistant to manipulation by providers and 'members'

The satisfaction of one of these criteria may be inconsistent with the satisfaction of others, however. For example, past use of health-care has been shown to be the best predictor of future use (Eggers 1981, McLure 1982) but the quantity of health-care use is the result of provider and beneficiary decisions, and hence a formula based on past use of care is subject to manipulation. McClure (1984) therefore argued that risk factors (or weights) should include only characteristics of the individual or population that are independent of providers of care. In particular

> "Fair and accurate capitation payment requires a set of risk factors that will divide all beneficiaries into a set of mutually exclusive risk groups each with a specified risk value" (McClure 1984, p208)

In terms of the practical application of risk factors, capitation rates for HMO enrollees under the Medicare programme are based on mean per capita costs adjusted for age, gender, disability status (registered disabled or not) and institutional status (resident or non resident of a health-care institution). Yet these factors have been found to account for only 0.6 per cent of the variation in expenditures between beneficiaries (Lubitz et al. 1985).

Several approaches have been suggested for introducing other variables to help identify groups of the population which are homogeneous in their probability of health-care use (and hence help explain variations in expenditures). These fall under five broad headings: non-discretionary service utilization; self-perceived health status; functional health status; programme entitlement; and mortality rates (see Appendix 1).

Of all these types of indicators, mortality data appear to fit the needs of the ideal capitation formula best, although concerns have been expressed about the possible perverse incentives of its use (i.e., increased mortality leads to increased per capita resource allocations), and about statistical problems when the formula is to be applied to a self or provider-selected population (see Newhouse 1986).

Several points are worth emphasizing in the context of population-based health-care resource allocation in Canada:

a. The identification of possible risk factors has been based on a variable's ability to explain variation in past use. Yet use is an inappropriate 'gold standard' where concern is primarily with allocating resources in accordance with needs for health care.

b. A major rationale for government intervention in the funding of health-care services is the need for risk-sharing in response to the unpredictability of needs for care. Consequently the failure to explain a large proportion of observed variation in health-care expenditures in populations should not be interpreted as poor specification of the expenditure equation.

The value of a needs indicator should not be assessed solely in terms of the proportion of the total variation in health-care use it explains.

In response to this, three strategies have been suggested:

* concentrate attention on identifying risk factors for chronic conditions in order to explain the permanent or non-random elements of observed variation in expenditures, which Newhouse (1982) estimates to be only around 20 per cent of the total variation. Similarly, McLure (1984) argues that the capitation rate adjustments should focus on risks of chronic conditions because these relate to continuing health-care requirements.

* evaluate the predictive power of proposed capitation formulae across population groups as opposed to individuals in order to reduce the impact of the random component of variation (Lubitz 1987).

* following Lubitz (1987), calculate capitation rates on a geographical basis to remove the 'within-region' random component of variance (Sisk et al. 1987).

c. The U.S. literature has generally focussed on risk-rating and capitation adjustment in elderly populations because current policy concerns are concentrated on the Medicare programme. Although the underlying problem of risk-adjustment is general to health-care resource allocation for all age groups, it is not clear how applicable the U.S. studies are to the allocation of health-care resources for general populations.

Some studies have considered capitation-adjustments for non-elderly groups (Save

et al. 1989, Volicer and Romagnoli 1988). The focus of these studies has been the explanation of between-beneficiary variation in costs of employer-based pre-paid health-care benefits. In other words, it has been primarily concerned with factors explaining past use of services as opposed to factors predicting future health-care needs.

### 3.3 Population-based planning of health care resources: Findings from U.K. studies

The U.K. research focuses on allocating a fixed health-care budget in line with needs for care. Indicators of population needs for health care were introduced into a formula of resource allocation for hospital-based services in England in the late 1970s. The formula (RAWP, after the Resource Allocation Working Party on whose recommendations it was based) replaced a previous allocation formula under which health-care regions received allocations based on populations weighted by hospital bed numbers and caseloads. The authors of the RAWP report (U.K. Department of Health and Social Security 1976) noted that these allocations reflected existing supplies of hospital services and hence any inequalities in access to such services between regions were perpetuated by the allocation methodology.

The RAWP report recommended weighting populations by an indicator of morbidity or need for health care that was free of such supply influences. Several types of indicators were considered and the characteristics of each indicator were identified (see Table 3.1). Following consideration of these characteristics, the Standardized Mortality Ratio (SMR) was adopted as the most appropriate indicator of needs for the purpose of the formula. A region's funding level was adjusted to its 'target' (or appropriate) level (share) over time by allocating additions to the national hospital budget unequally, in favour of the 'under-target' regions. In 1979-80 six of the fourteen regions were below their target; by 1986-87 no region was funded less than 96 per cent of its target level.

The formula, and in particular the use of SMRs as an indicator of need, has

**Table 3.1 Characteristics of potential needs indicators for use in resource allocation**

| Indicator | Characteristics |
|---|---|
| 1. Sickness-absence statistics | . covers only parts of the population<br>. reflects a region's employment structure<br>. not sensitive to severity of need<br>. criteria change over time |
| 2. Population-based self reports of sickness | . perceptions based (subjective)<br>. based on small proportions of the populations of interest<br>. often not co-terminous with health-care providers' populations |
| 3. Specific survey data | . measurement of morbidity is problematic<br>. frequent data collection infeasible |
| 4. Mortality (adjusted for demographic mix) | . covers the whole population<br>. data collection is continuous<br>. population based<br>. broken down by cause<br>. observed variation 'corresponds' to observed variation in morbidity |

generated considerable debate in the health services research literature. Although this literature cannot be reviewed in full here (see Mays and Bevan (1987) for a more comprehensive critical appraisal) the main points of the debate are summarized below under six categories.

**A. Mortality as a proxy for morbidity**

* Forster (1977) found no significant rank correlation between SMRs and self-reported acute sickness, or 'bed sickness', at the regional level based on an analysis of two years' data from a national population-based survey

* Within this analysis, self-reports of chronic sickness were found to correlate well with mortality

* Using a simple regression model and alternative proxies for morbidity, Palmer (1978) found that SMRs were a good predictor of variations in cancer prevalence rates and self-reported chronic sickness, at the regional level

* Statistically significant correlations were found between age-group specific mortality rates and the prevalence of census-based reports of 'sick and therefore unemployed' and 'permanently sick and therefore not seeking work', even at the small area population level (Brennan and Clare 1980).

* At the electoral district level, Townsend et al. (1986) found statistically significant correlations between SMRs (ages 0-64) and census based records of permanent sickness and live births under 2800 grams.

Summary: Although mortality may not be a good indicator of all types of morbidity, findings from the literature indicate that it does correlate significantly with those types of morbidity that are associated with considerable and continuing needs for health care (e.g., chronic and permanent sickness)

**B. Mortality as a proxy for needs-based service utilization**

* Ferrer et al. (1977) argued that some conditions generate needs for health care but are not life-threatening

* Fox (1978) argued further that even where death may be a possible outcome of an episode of an illness, prevalence of the disease may not correlate significantly with mortality rates.

* Allowance was made for these features in the RAWP formula by

  - not using SMRs to weight for needs for care for non-life threatening conditions (e.g mental illness)

  - weighting the (condition-specific) SMR by aggregate levels of bed utilization for the condition in the total population where SMRs are used as a needs indicator (i.e. gives extra weight to conditions with high levels of use but low mortality and less weight to conditions with low levels of use but high mortality).[2]

* Bennett and Holland (1977) found that

  - the main chronic conditions which exhibit poor correlations between morbidity and mortality show little regional variation

  - the conditions giving rise to large proportions of hospital admissions (circulatory and respiratory disease in particular) showed high correlations with mortality

  - based on these findings they suggested that SMRs were a good proxy for morbidity for those conditions generating major service needs.

Summary: For those conditions for which considerable health-care provision is needed, and for which considerable variation in prevalence is observed between regions, SMRs are a good proxy for morbidity.

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[2] One implication of this is that it 'freezes-in' the existing approach to condition-specific service provision (eg., substitution of day surgery may be appropriate but allocations would reflect a current practice of inpatient stays).

## C. The relationship between mortality and health-care needs

* Simple, multiplicative weighting of populations by SMRs implies a linear relationship between mortality and needs for care (i.e., an SMR of 110 would generate a 10 per cent increase in resources relative to the national mean level) (Barr and Logan 1977, Fox 1978)

* Although the precise nature of the relationship has not been explored widely in the literature, Brennan and Clare (1980) observed linear relationships between SMRs and 'permanent sickness' and 'sick and unemployed'

Summary: On the basis of this one study, there is some support for the linear relationship although further research on this issue would be helpful.

## D. Perverse incentives in the formula

* Regions that achieve reductions in SMRs are 'penalized' (Forster 1978)

* Reductions in SMRs may be achieved at the 'expense' of increased needs for care (i.e., more chronic illness) (Sanderson 1979)

* Use of SMRs as a needs indicator is insensitive to the cause of a particular level of SMR i.e., a low SMR may reflect a low level of need (morbidity) or a high level of effectiveness

* But the formula is concerned with allocating resources in line with needs for care (i.e. equal opportunities to access care when in need), not with securing equal levels of efficiency

Summary: The needs-based allocation formula is not concerned with performance evaluation. As with other methods of resource allocation, performance appraisal is a separate issue.

## E. The standardized mortality ratio as a measure of mortality

* SMRs are biased towards deaths in older age groups because greater weight is given to age groups with larger shares of expected deaths (Sanderson 1979) (see Appendix 2 for a detailed discussion of alternative mortality indices)

* Changes in age-specific death rates in younger age groups are more likely to reflect relative needs for health care than changes in the older age groups. Chronic conditions in the elderly give rise to high demands for services, but do not result in deaths. So the mortality experiences of the elderly are likely to reflect the accumulated hazards of a lifetime rather than current circumstances (Mays and Bevan 1987). Furthermore the certified cause of death is generally less reliable for older groups (Palmer et al. 1979).

* For these reasons, SMRs based on age groups 0-64 have been used in the Scottish allocation formula, and in England, the formula was amended in 1987 to exclude deaths in age groups 75 and over (Mays 1989, Carr-Hill 1989).

Summary: The SMR is not an unbiased measure of relative risk of death. But as an indicator of need in a resource allocation formula it appears to be a conservative adjustment factor (Palmer et al. 1979).

## F. Mortality and social deprivation

* The use of SMRs as the sole indicator of need has been criticized because it fails to recognise the impact of poverty, crowding and other aspects of social deprivation on health-care needs (Fox 1978). Social deprivation might affect health-care needs in two ways:

  (1) it might affect the ratio of mortality to morbidity (social deprivation gives rise to a higher need for care in clinical terms than is indicated by mortality rates alone)

  (2) it might affect the cost of meeting a given health-care need (e.g., poor social conditions may inhibit early discharge from hospital)

* Although strong correlations are observed between social deprivation and mortality, both in terms of individual indicators of deprivation (e.g., Forster 1979, Brennan and Lancashire 1978, Knox et al. 1980, Townsend et al. 1984) and combined indices (e.g., Carstairs 1981, 1982), to weight allocations for social deprivation risks "double-counting" needs, as noted by the authors of the Black Report.

* although other research has shown social deprivation to be an important variable in explaining variations in health-care utilization rates (Jarman 1983, 1985), need indicators cannot be validated in terms of their relationship to health-care use, because of the effect of availability on use.

* if the objective of the resource allocation formula is to direct resources to areas of greatest need for health care (and by implication, potential to affect health status), then the addition of social deprivation weights would only be relevant where these weights represented risks to health over and above those proxied by mortality indices. If the prevalence of social deprivation per se is the problem of concern then policies other than health-care provision should be considered which address the problem more directly.

Summary: There is considerable empirical support for positive correlations between morbidity and socioeconomic conditions, but at least some of this relationship will be reflected in the observed correlations between morbidity and mortality. Although a social deprivation factor has been introduced recently into the English formula, the methodological basis for this policy and its application has been shown to suffer from severe limitations (Carr-Hill 1989, Mays 1989).

## Section 4: A profile of the study population

## 4.1 Rationale for constructing a profile of the population

The core of the needs-based approach consists of estimating the relative need for health care in the study population by comparing levels of morbidity in the study population with levels of morbidity in the rest of the provincial population. In the absence of an available morbidity measure which is not based on use of health- care services, and hence contaminated by the influence of the available supply of care, other measures of health-care needs have to be used. Of particular interest are population characteristics that have been found in previous research to correlate positively with risks to health and the prevalence of illness (see Section 3.1). By measuring the levels or rates of these characteristics a profile of health-related factors can be constructed for the study population and compared with the provincial profile.

Proxy measures of health risks and the prevalence of illness have previously been used elsewhere to compare communities or regional populations and to form a basis for allocation of health-care resources (see Section 3). In particular, Ministries of Health in the U.K., Australia, New Zealand and the Netherlands have allocated hospital budgets on the basis of estimated population needs. In addition, population and individual health-risk factors are currently being proposed as adjustment factors for capitation rates for the funding of Health Maintenance Organizations (HMOs) under insurance plans in the U.S.A.

The use of population risk factors as a basis for health-care resource allocation has not received much attention to date in Canada. As discussed in Section 3.1, several studies have identified positive relationships between population characteristics and population health status in Canadian populations, which correspond to the relationships observed in other countries. But the application of these correlates of population health status to health-care resources allocation has not been widely adopted.

## 4.2 Definition of the study population

The population of interest consists of individuals currently served by the hospitals in Fort Frances, Rainy River and Emo and by the physicians associated with the Fort Frances Clinic. Because this catchment population does not coincide with any recognised service population, no published data were available on the characteristics of the study population. We therefore defined the study population in terms of geographical units at the small area level of the national census, for which community profiles are available.

The study population consists of the administrative district of Rainy River, less Atikokan and the Eastern part of the 'unorganized' community of Rainy River district, plus Sabaskong Bay (Indian Reserve) and Nestor Falls (Godson township), both of which lie outside Rainy River District, in the neighbouring district of Kenora (see Figure 4.1). Each of these elements can be identified in the census data (i.e., they constitute census units at the level of the sub-division or higher) with the exception of Nestor Falls and the Eastern part of Rainy River unorganized. Where possible, data on these two smaller populations were obtained from Statistics Canada by applying geographically defined boundaries within the census sub-divisions to the raw census data. However, this approach could be used only where sufficient numbers existed to preserve the anonymity of individuals.

Unless otherwise stated, each part of the profile is based on this study population using data from the 1986 census.

## 4.3 The size and demographic mix of the population

The risks to health and therefore need for health care in a community will be affected by both the size of the population and the distribution of the population among age groups and gender. The size of the study population was estimated using the geographical definition described above. Age and gender distributions of the respective elements of the study population were provided from the raw census data with two exceptions. The age

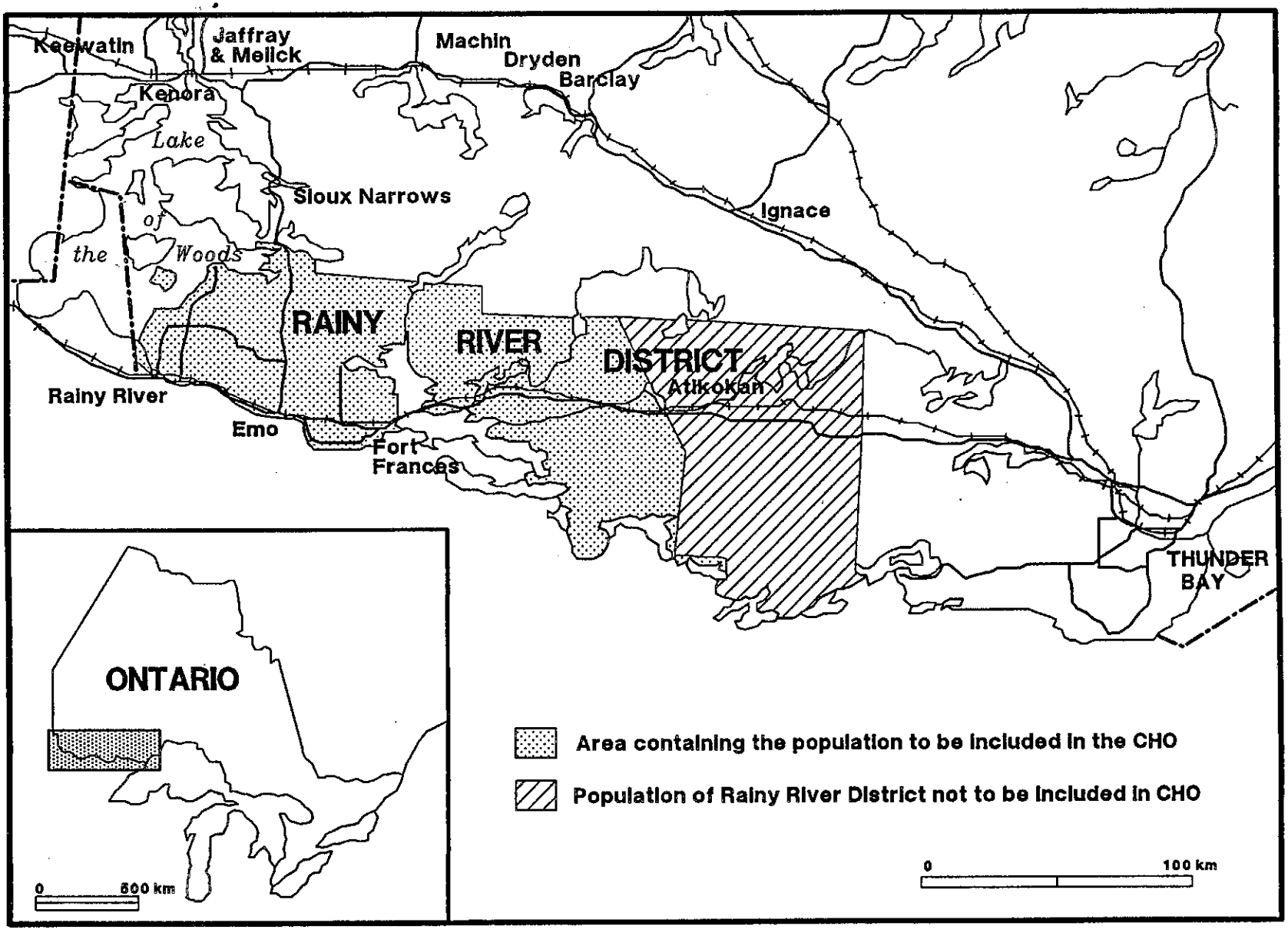


FIGURE 4.1: THE FORT FRANCES - RAINY RIVER STUDY AREA.

distribution of the Nestor Falls population, and the age and gender distribution of the populations of two Indian Reserves (Rainy Lake 17B and Rainy Lake 18C) were not available. These distributions were imputed as follows:

a. The gender-specific population of Nestor Falls was allocated across age groups in line with the gender-specific age distributions of the rest of the non-Reserve study population.

b. The combined population of the Rainy River 17B and Rainy Lake 18C Reserves (29 persons) was allocated across age and gender groups based on the age and gender distributions of the rest of the Reserve populations included in the study.

In addition, one Indian Reserve, Seine River 26A, did not participate in the 1986 census. Data from the 1981 census were used, under the assumption that size and demographic mix of this Reserve's population was the same in 1986 as in 1981. This assumption was considered to be reasonable following discussions with the officers of the local District Health Council.

The total population of these three areas for which precise demographic details were not readily available constitutes less than 2.5 per cent of the entire study population. These assumptions are therefore unlikely to have an impact on the estimates of resource requirements for the CHO.

The data on the size and demographic mix of the study population are presented in Table 4.1 along with comparative data on the age distribution of the provincial population. The study population contains greater proportions of both the old and young. This indicates that allowance for the differing demographic mixes should be made in calculating an average per capita resource provision for the study population.

Table 4.1 **Size and demographic mix of the study and provincial populations, 1986**

| | Study Population | | | | | | Ontario | |
|---|---|---|---|---|---|---|---|---|
| | Male | | Female | | Total | | Total | |
| Group | No. | % | No. | % | No. | % | No. | % |
| 0-4 | 737 | 3.9 | 728 | 3.8 | 1,465 | 7.7 | 631,390 | 6.9 |
| 5-9 | 759 | 4.0 | 736 | 3.9 | 1,495 | 7.9 | 608,160 | 6.7 |
| 10-14 | 847 | 4.5 | 772 | 4.1 | 1,619 | 8.6 | 629,870 | 6.9 |
| 15-24 | 1,549 | 8.2 | 1,470 | 7.8 | 3,019 | 15.9 | 1,503,775 | 16.5 |
| 25-34 | 1,496 | 7.9 | 1,437 | 7.6 | 2,933 | 15.5 | 1,583,020 | 17.4 |
| 35-44 | 1,197 | 6.3 | 1,078 | 5.7 | 2,275 | 12.0 | 1,316,910 | 14.5 |
| 45-54 | 844 | 4.5 | 862 | 4.6 | 1,706 | 9.0 | 950,090 | 10.4 |
| 55-64 | 904 | 4.8 | 911 | 4.8 | 1,815 | 9.6 | 885,785 | 9.7 |
| 65-74 | 738 | 3.9 | 845 | 4.5 | 1,583 | 8.4 | 602,610 | 6.6 |
| 75+ | 416 | 2.2 | 605 | 3.2 | 1,021 | 5.4 | 390,090 | 4.3 |
| All ages | 9,502 | 50.2 | 9,429 | 49.8 | 18,931 | 100.0 | 9,101,700 | 100.0 |

Note: The Study Population includes all of the Rainy River District, less Atikokan and the Eastern part of Rainy River Unorganized, as well as including both Nestor Falls and Sabaskong Bay from the Kenora District

Source: 1986 Census Information, Statistics Canada.

## 4.4 Population resident on Reserves

Almost 10 per cent of the study population are residents on Reserves, compared to 0.3 per cent of the total provincial population (see Figure 4.2). Native persons not resident on Reserves cannot be identified in the census data but it would appear plausible to assume that this group also constitutes a greater proportion of the study population than of the provincial population. We might expect this to increase the health-care needs of the population given that native populations generally have poorer levels of health than non-natives (Shah and Farkas 1985).

## 4.5 Incomes

Information on incomes was collected on the 'longform' of the 1986 census, which was circulated to 20 per cent of the population. These income data were not available for populations below the level of census sub-division. Hence, compared to the study population, the income data include the Eastern part of the unorganised population of Rainy River but exclude Nestor Falls. Greater proportions of families[3] in the study population fall into the lower income groups and smaller proportions fall into the higher income groups compared to the provincial population. For example, 37 per cent of study population families had incomes less than $25,000 in 1986 compared to only 28 per cent of families in the province (see Figure 4.3). But the number of persons per family is slightly less (3.10) in the study population than in the provincial population (3.25) indicating that the income differential between the study population and the provincial population would be less after standardizing for family size.

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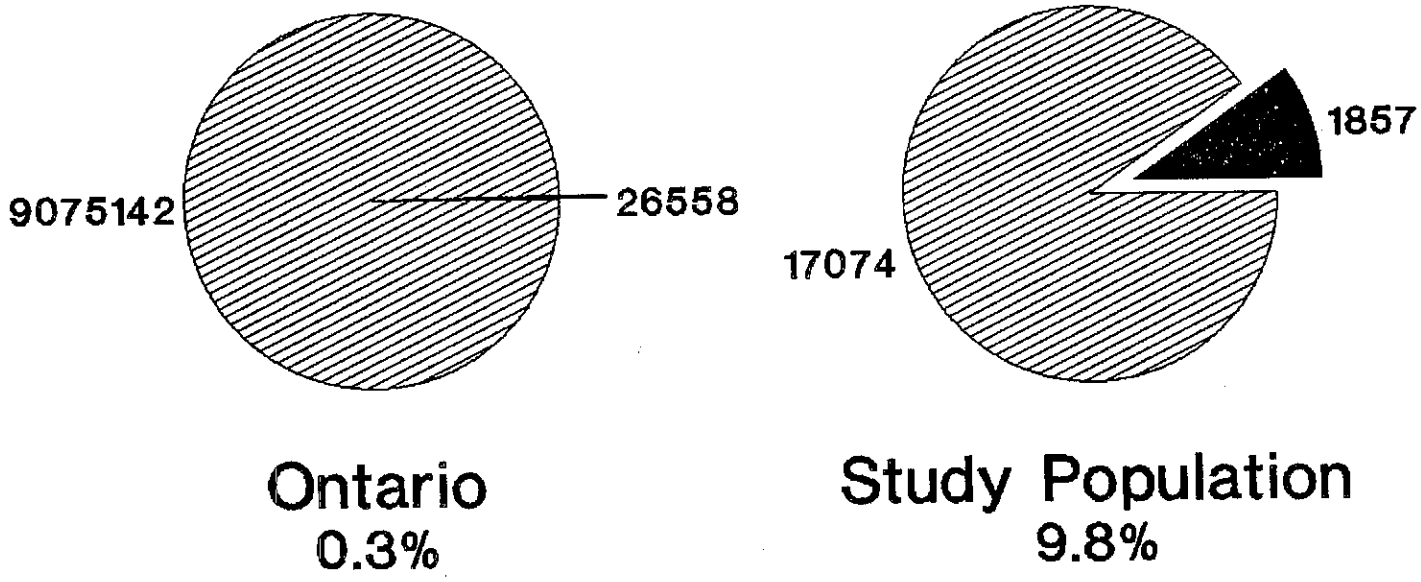
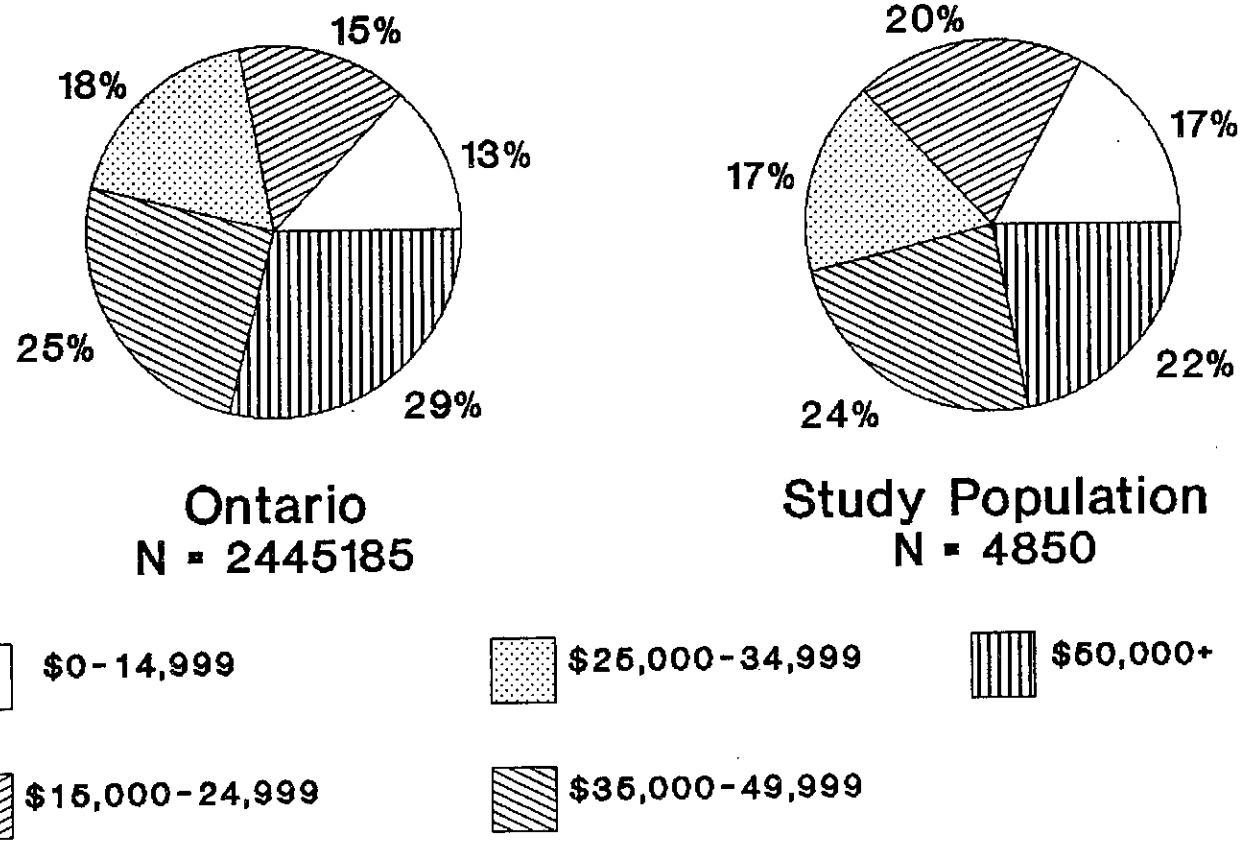
[3] Defined in the census as two or more persons who live in the same dwelling and are related to each other by blood, marriage or adoption.

# Figure 4.2 Native Reserve Population



# Figure 4.3 Family Income

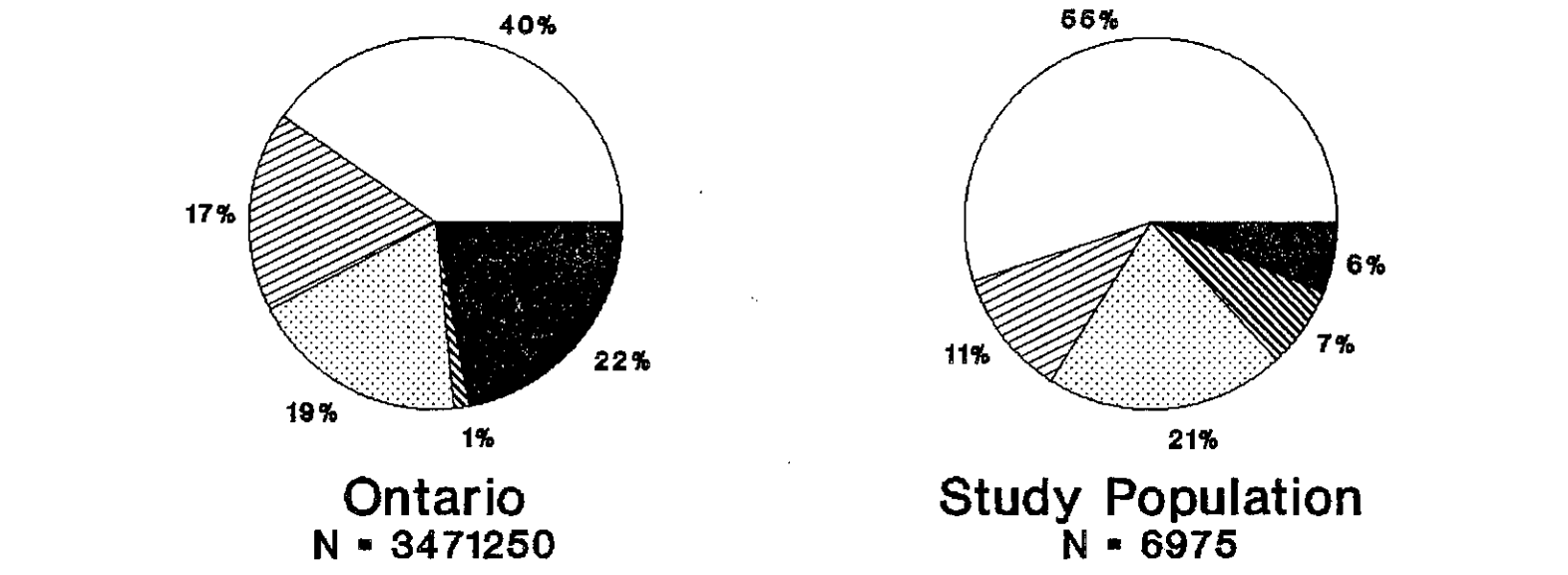


Information was not available on the distribution of family incomes in the $50,000 and over group, but the median and mean family incomes are much lower in the study population ($21,449 and $23,885 respectively) compared to the province ($36,978 and $41,692). On the other hand, the proportion of individuals in low income families (defined in the census as spending at least 58.5 per cent of total family income on food, shelter and clothing) is less in the study population (11.0 per cent) than in the provincial population (13.4 per cent). This is probably explained by the lower costs of housing in the study population relative to the costs of housing in the large urban centres where most of the provincial population resides. Overall, the data on the relative income position of the study population are ambiguous. Greater proportions of families in the study population fall into low income groups than in the province as a whole, but when compared with the differing income needs, it appears that the incidence of low income families is no greater than in the provincial population.

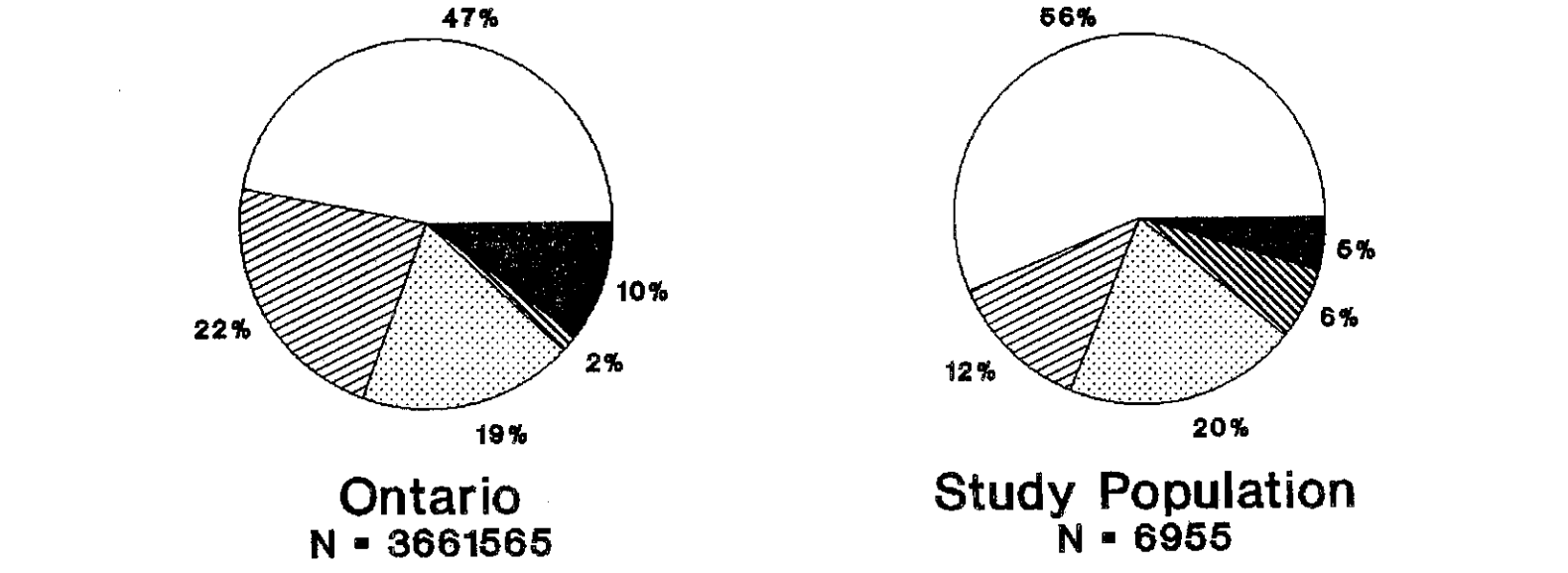
## 4.6 Education

As with the income data, the education data were derived from the census long form and are based on the same population. In general larger proportions of the study population have lower levels of education than for the provincial population (see Figures 4.4 and 4.5). Only six per cent of males and five per cent of females age 15 and over in the study population have a university degree or equivalent, compared with corresponding figures of 22 per cent and 10 per cent for the province. Similarly, larger proportions of the study population (55 per cent of males and 56 per cent of females) do not have a secondary school graduation diploma than for the province (40 per cent of males and 47 per cent of females). Given observed correlations between education and health risks (e.g., Saveland and Gillieson 1982), these data support the need for higher than average per capita health-care resources for the study population.

# Figure 4.4 Highest Level of Schooling
## Males



# Figure 4.5 Highest Level of Schooling
## Females



## 4.7 Marital Status

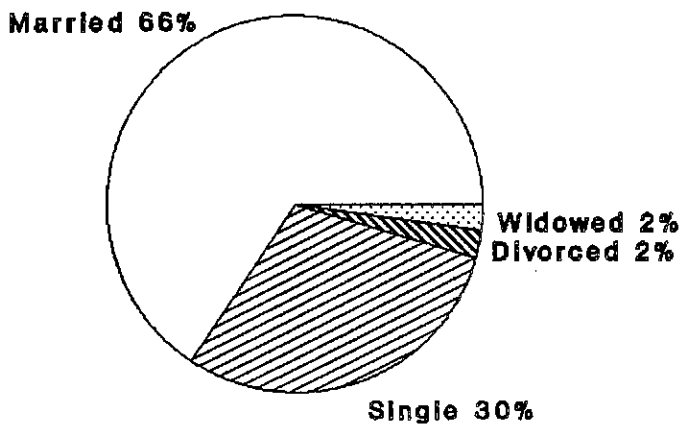
Approximately the same proportions of males in the study population fall into the categories of single, married, widowed, and divorced as for males in Ontario (see Figure 4.6). For females, there are greater proportions of married and widowed, and lower proportions of single and divorced than in Ontario (Figure 4.7). When the data are broken down by age group, the greater prevalence of married status among females is common to all age groups. For males, younger age groups have a greater prevalence of marriage than for the province as a whole; the opposite is observed for ages 35 and over. In terms of the effects on health risks of support networks associated with the presence of a spouse (see for example, Berkman and Syme 1979, House 1988), these data indicate that the per capita resource needs of the study population are lower than for the Ontario population, other things equal.

## 4.8 Alcohol and illegal drugs

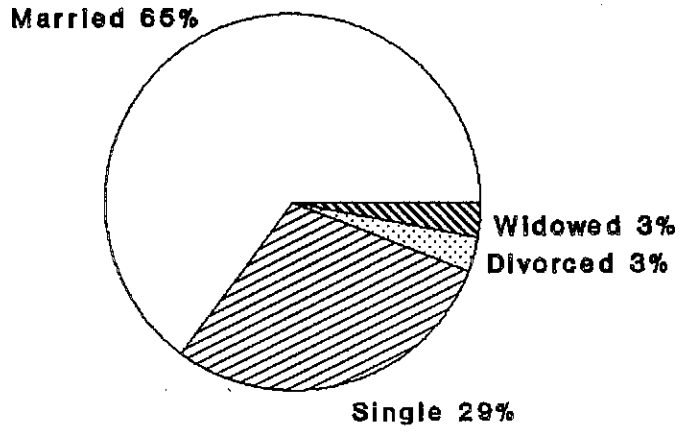
The census did not collect information on lifestyles but the Addiction Research Foundation maintains data on alcohol and drug use (Addiction Research Foundation 1988). As shown in Tables 4.2 and 4.3 there appears to be a greater prevalence of alcohol and illegal drug use in the study population than in Ontario as a whole. (The data actually pertain to Rainy River district only, but are here used as a proxy for the study population.) There are a number of limitations, however, to using these data to construct a profile of the study population. First, the alcohol consumption data are based on alcohol sales in the area. But sales data are likely to be a poor proxy for consumption in the study population because:

a) tourism is a major industry in the district, particularly during the summer. Sales figures will reflect in part the behaviour of this major influx of population.
b) the district is located close to the Manitoba and US borders and consumption

# Figure 4.6 Marital Status
## Males 15+

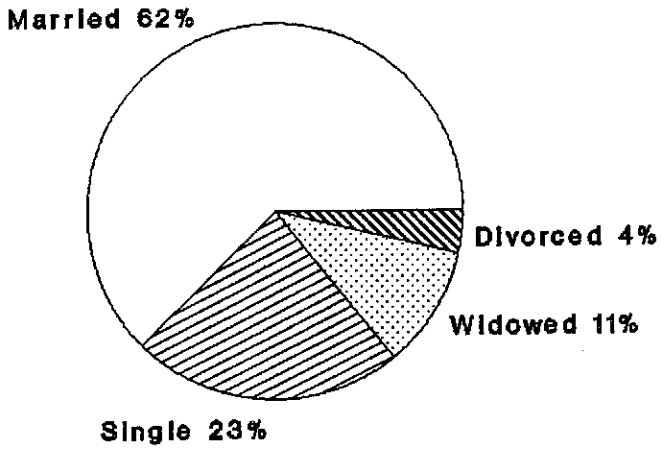



Ontario
N = 3509575

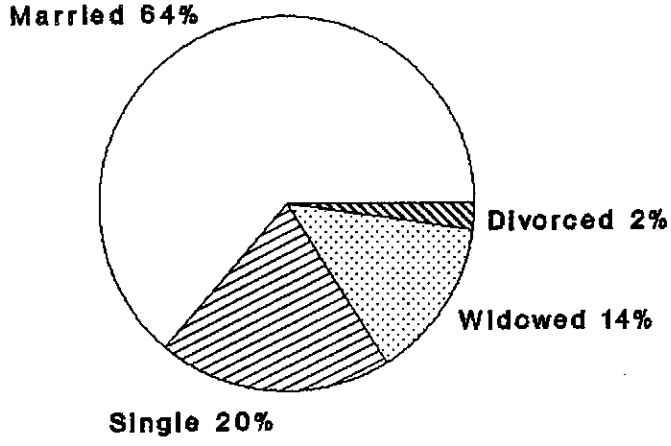



Study Population
N = 7115

# Figure 4.7 Marital Status
## Females 15+




Ontario
N = 3722690




Study Population
N = 7145

Table 4.2 **Estimated alcohol consumption per capita 1985-6**

| | Rainy River District | Ontario |
|---|---|---|
| Absolute alcohol consumption (litres): | | |
| All ages | 9.1 | 8.1 |
| Age ≥ 15 | 12.0 | 10.3 |
| Prevalence of heavy drinking[1] per 1000 population age ≥ 15 | 40.4 | 32.7 |

[1] Eight or more drinks daily

Table 4.3 **Alcohol and illegal drug offences per 100,000 population 1985-86**

| | Rainy River District | Ontario |
|---|---|---|
| Offences involving alcohol | 6900 | 2240 |
| Offences involving illegal drugs | 404 | 196 |

Source: Addiction Research Foundation 1988.

of alcohol purchased outside of Rainy River, particularly imports of (lower priced) alcohol from the US, is expected to represent a considerable portion of consumption.

Second the data on alcohol and drug-related offences are based on the place of occurrence of the offence (as opposed to residence of the offender). Furthermore, the incidence of offences is likely to be influenced by the size and effectiveness of the police force. Notwithstanding these problems, the data support a generally accepted belief that the study population has relatively high levels of use of alcohol and illegal drugs, giving rise to health risks in excess of those experienced by the provincial population.

### 4.9 Mortality

The rate of mortality has been shown to be an indicator of the health-care needs of a population. (This issue was addressed in more detail in Section 3.) In order to provide a meaningful comparison of mortality rates between communities, allowance has to be made for the demographic mix of the populations under comparison (i.e., we would expect a greater number of deaths in a population concentrated in the older age groups than in a population with greater proportions of young people, other things equal). Several methods of adjusting crude mortality rates have been developed, the most familiar being the standardized mortality ratio (SMR). The first step in constructing an SMR is to calculate the age/gender specific crude mortality rates for the reference (provincial) population. The second step is to calculate the number of deaths that would be expected in the study population if it experienced the same age/gender specific death rates as the reference population. The SMR is simply the ratio of the actual number of deaths in the study population to this expected number of deaths (expressed as a percentage). Hence an SMR of over 100 indicates a higher than expected level of mortality in the study population.

Other mortality indices differ from the SMR in the relative weights attached to deaths occurring in different age groups (see Appendix 2 for a discussion of mortality

indices). For the purposes of this study, however, the SMR is used to provide a profile of risks to health for two main reasons:

a. it represents a conservative index of differences in adjusted death rates between communities (see Appendix 2)

b. it is widely used as a comparative measure of mortality and has been used as an indicator of health-care needs in other countries (see Section 3).

We obtained data from the MoH on the number of deaths in the province and in the population defined by Rainy River District less Atikokan, by age group, gender and cause of death (categorized according to the 17 ICD-9 major classification headings). Age group and gender-specific populations for the comparative groups were then used to calculate firstly, provincial rates of death by age group, gender and cause, and secondly, the SMRs for the study population.

Small numbers of observed deaths in some age, gender and cause of death categories limited the precision of the estimates (for example a small change in the number of deaths in a low mortality category could have a large effect on the calculated SMR). Two strategies were used to deal with this problem:

a. the SMRs were calculated using 10 years' data (1979-1988) on deaths and size of populations[4]. This reduces the impact of between-year fluctuations in observed deaths that occur by chance, and also provides larger numbers of observed deaths on which to base SMR calculations.

b. Confidence intervals were calculated for the SMRs in order to identify those

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4 The population figures were based on census data for census years 1981 and 1986, official population projections for other years.

causes of death for which the observed difference in the adjusted rate of death between the study population and the provincial population could not be attributed to chance (see Appendix 3 for the methodology used to calculate confidence intervals).

In this study SMRs are used as indicators of morbidity. Because of the way in which deaths in the different age categories are weighted in the calculation of SMRs, some have argued that SMRs used as proxies for morbidity should be based only on deaths among the non-elderly population rather than all age groups (see Section 3 for a fuller discussion of this issue). Therefore, we calculated two sets of SMRs, one using all age groups and one using only those in age groups <65.

The full set of SMRs and confidence intervals are recorded in Appendix 4. The SMRs which were found to be significantly different from 100 are recorded in columns 1 and 2 of Table 4.4. The general picture that emerges from these data is that the study population has a significantly greater rate of death than the province. After adjusting for the age mix of the population, the rate of mortality in the study population is approximately 10 per cent greater than in the provincial population. However when deaths in the non-elderly population alone are considered the 'excess' rate of mortality in the study population increases to almost 30 per cent. In terms of specific causes of death, the study population has significantly greater rates of death from neoplasms and diseases of the circulatory system than the provincial population (although the greater incidence of deaths from neoplasms is confined to the non-elderly population). The higher rates of death are common to both genders, as are deaths due to injuries and poisoning, which occur at almost twice the rate for these causes in the province. These conditions are the three most important causes of death in the non-elderly population in both the province and in the study population, and were also responsible for 35 per cent of all hospital bed days in Ontario in fiscal year 1987-88.

The only other significant differences in SMRs in the non-elderly population are for

Table 4.4 **Study population standardised mortality ratios[1,2] significantly different[3] from 100, by ICD category and gender**

| | All ages | | Ages 0-64 | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| All conditions | 110.8 | 109.9 | 127.0 | 128.4 |
| ICD category: | | | | |
| 1. Infectious/Parasitic Dis. | 56.5 | n.s. | n.s. | n.s. |
| 2. Neoplasm | n.s.[4] | 98.6 | 105.7 | 105.0 |
| 3. Endocrine, Nutritional and Metabolic Diseases | 147.3 | n.s. | n.s. | n.s. |
| 4. Diseases of the Blood | 74.5 | n.s. | n.s. | n.s. |
| 5. Mental Disorders | 73.0 | n.s. | n.s. | n.s. |
| 6. Diseases of Nervous System | 57.6 | n.s. | 68.6 | n.s. |
| 7. Diseases of Circ. System | 111.4 | 109.9 | 120.9 | 112.2 |
| 8. Diseases of Resp. System | n.s. | 125.8 | 60.4 | 192.7 |
| 9. Diseases of Digest. System | 86.0 | 146.5 | 78.0 | 182.2 |
| 10. Diseases of Genito-urinary System | 65.7 | n.s. | n.s. | n.s. |
| 14. Congenital Abnormalities | 49.3 | n.s. | 35.1 | n.s. |
| 15. Certain Conditions of Perinatal Period | 272.9 | n.s. | 272.9 | n.s. |
| 16. Symptoms, Signs and Ill Defined Conditions | 138.7 | 285.0 | n.s. | n.s. |
| 17. Injury and Poisoning | 173.6 | 127.9 | 199.8 | 195.9 |

Footnotes:

1 Based on deaths in the population of Rainy River District less the population of Atikokan

2 Based on population projections and deaths statistics for the period 1979-1988

3 $p = 0.05$

4 n.s. = not statistically significantly different from 100

diseases of the respiratory and digestive system (females) and deaths from conditions originating in the perinatal period (males), which are significantly higher in the study population, and for diseases of the nervous system, the digestive system, the respiratory system and congenital abnormalities (all males) which are significantly lower in the study population.

In so far as mortality rates provide a valid indicator of morbidity and the need for health care (see Section 3), these data indicate that the study population is at significantly greater risk of illness, with the excess risks being concentrated in those conditions which represent the major causes of both death and hospital utilization in the province. This suggests that the capitation rate for the study population should reflect these additional per capita needs of the population.

### 4.10 Fertility and birthweight

Both the rate at which women in a population give birth (live and still) and the incidence of low birthweight babies (live births only) will affect directly the population's needs for health-care resources, over and above adjustments made for the age group and gender mix of the population.

The standardized fertility ratio (SFR) is a measure of the birth rate in a population after allowing for the age distribution of females. It expresses the observed number of live and still births in the study population as a percentage of the number of births we would expect if females in the study population gave birth at the same age-group specific rates as females in the province. As with the calculations for SMRs, the SFR calculation was based on data for the ten year period 1979-1988.

The SFR for the study population was 120 (see Table 4.5) indicating that women in the study population had more babies than would be expected on the basis of age-group specific rates of fertility in the province.

Table 4.5 **Births by age of mother and birthweight for the study population and Ontario 1979-1988**

| Age | Study population | | | Ontario | | |
|---|---|---|---|---|---|---|
| of mother | Stillbirths | Livebirths <1500gms | Livebirths >1500gms | Stillbirths | Livebirths <1500gms | Livebirths >1500gms |
| <14 | 0 | 0 | 0 | 7 | 6 | 649 |
| 15-24 | 10 | 11 | 1387 | 3036 | 3917 | 414027 |
| 25-44 | 13 | 10 | 1446 | 5757 | 7102 | 862088 |
| 45+ | 0 | 0 | 2 | 12 | 5 | 331 |

Source: Ontario Ministry of Health

Standardized Fertility Ratio (SFR):

$$SFR = \frac{\text{Observed total births}}{\text{Expected total births}} \times 100 = \frac{2887}{2399} \times 100 = 120$$

Standardized Very Low Birthweight Ratio (SVLBR):

$$SVLBR = \frac{\text{Observed live births } <1500\text{gms}}{\text{Expected live births } <1500\text{gms}} \times 100 = \frac{21 \times 100}{25.03} = 84$$

In addition to the numbers of children born, health-care needs are also affected by the incidence of very low birthweight babies. Very low birthweight is defined here as less than 1500 grams (on the basis of birthweight categories used in administrative data sets). Babies in this category are at high risk of complications and consequently face a greater probability of requiring neonatal intensive care facilities. A standardized very low birthweight ratio (SVLBR) for the study population was calculated using the data on live births categorized by birthweight. The SVLBR is given by the observed number of very low birthweight babies in the study population expressed as a percentage of the number expected if maternal age-group-specific rates of very low birthweight in the province occurred in the study population (see Table 4.5).

The calculated SVLBR for the study population was 84 indicating that the incidence of very low birthweight is 16 per cent lower than in the province after adjusting for maternal age-specific fertility rates. This indicates that other things being equal, the health-care needs of the study population for dealing with low birthweight babies are less than those in the provincial population.

## 4.11 Overview

The overall picture is that the study population has a relatively low proportion of young adult, highly educated, high income persons compared to the provincial population. A greater proportion of the study population are in families with low levels of income but fewer are in families defined as in poverty, which takes into account the proportion of family income spent on basic essentials (housing, food and clothing). The study population is at greater risk of dying from the three major causes of death in the province (cancers, circulatory disease and accidents and poisoning) and appears to be participating in high risk behaviours (alcohol and illegal drug consumption) at a greater rate than the provincial population. Study population females are more likely to have a baby than females in the rest of the province. Each of these factors indicates that the study population has a greater need for health-care resources than would be provided by an equal per capita distribution.

On the other hand, the greater prevalence of spouses in the study population and the lower risk of a study population baby being of very low birthweight indicate that health-care resource needs are less than in the provincial population.

# Section 5: Setting capitation rates: Development of a needs-based methodology

## 5.1 Assumptions of the current study

In this section a methodology is developed for calculating a capitation rate for a CHO in the context of 1988-89 provincial levels of resource allocation to each health-care programme. Our goal is to develop population needs-based formulae for distributing each of these programme 'budgets' among populations. The formulae will then be applied to the study population to derive a capitation rate for the Fort Frances CHO. In essence, therefore, the study involves calculating separate capitation rates for each programme which, when aggregated, produce a global capitation rate. Accordingly adjustments can easily be made to the calculated capitation rates to exclude particular programmes if required, or to include other programmes that are not currently covered by the capitation rate.

In developing a methodology, several assumptions are made concerning the accountability and service coverage under the capitation rate. These are:

i) Service provision:

The CHO will assume financial accountability under its capitation rate for its defined population (i.e., 'members') for the following services: primary and secondary medical care, hospital inpatient care, hospital-based outpatient care, services currently provided under the Ontario Drug Benefit plan, extended care (i.e., care provided in nursing homes and chronic care hospitals), inpatient and community based mental health services, home care, ambulance and emergency services, assistive devices and community health laboratory services (excluding laboratory proficiency testing).

Financial accountability for child and family intervention services, child treatment (mental health) services and residential (developmental) services will be assumed under an estimated supplement to the main capitation rate.

ii) Service use by CHO and non-CHO members:

CHO responsibility under the capitation rate includes the costs of services provided

by non-CHO providers to CHO members on referral by a CHO provider. But the estimated capitation rate does not take account of;-

- non-CHO provision to CHO members without referral by a CHO provider (i.e., patient self-referral)

- CHO provision for non-CHO members

(iii) Non-capitated services:

Services and activities of the CHO which do not relate directly to population needs-based service utilization will continue to be funded separately (e.g., capital grants, continuing medical education, underserviced area plan, grants to compensate for municipal taxation, venereal disease control).

(iv) Performance appraisal:

A formal system of performance appraisal will be introduced to monitor and evaluate the CHO's performance.

## 5.2 Developing a methodology

The simplest form of capitation funding would be to allocate health-care resources on an equal per capita basis. But as our review shows, the needs for health care are not equal for all individuals and adjustments to an equal per capita resource allocation are required if the resulting allocations are to be consistent with the efficiency and equity goals underlying the health-care system (see Section 2). The framework used here is to make adjustments to equal per capita rates to allow for three types of influences on the resource requirements of a CHO; influences of demography, health-care needs (other than those indicated by demography) and the relative cost of providing for a given level of health-care needs. To make these adjustments, the capitation rate calculation consists of three stages.

a. Age/gender-adjusted resource requirements

In this step allowance is made for age and gender differences in health-care needs. The calculated capitation rate is adjusted to reflect the particular age/gender distribution of the study population. For each service programme, provincial rates of utilization by age and gender (where available) are applied to the study population. This generates a study population baseline level of need which is then expressed as a percentage of the provincial utilization to produce a baseline share of the budget. The dollar amount of the baseline share of the budget is then expressed in per capita terms by dividing by the size of the study population. (See Appendix 5 for the precise mathematical formula). For services where eligibility is not universal (e.g., Ontario Drug Benefit plan) the adjustment is based on the number of individuals eligible for the programme (see Section 6).

b. Needs-adjusted resource requirements

In this step, allowance is made for variations in health risks and the need for health care not explained by age and gender alone. For each service programme, an index of need is applied to the baseline resource requirements from (a) above. This 'needed' level of use is then expressed as a percentage of the total programme, and a capitation rate is calculated following the approach in (a) above (see Appendix 5 for the precise mathematical formula).

Standardized mortality rates for the study population are used as an indicator of need for health care in the capitation formula for most programmes. The SMRs are calculated for deaths occurring in age groups 0-64 based on 10 years mortality experience (see Section 4). For some programmes, however, the SMR are not used as an indicator of need for health care (e.g. mental illness programmes, obstetric care) and other needs indicators are chosen (see Section 6).

The reasons for choosing the SMR as an indicator of need are both conceptual and practical. In particular;

a. population-based mortality measures are independent of health-care utilization rates

b. previous research in the U.K. has shown the SMR to be a valid indicator of health-care needs. Furthermore there is some indication from these studies that the relationship between SMRs and health-care needs may be linear

c. accuracy of mortality records is not generally problematic (particularly for the non-elderly) and the data are collected continuously for the whole population and reported frequently

d. SMRs have been found to correlate closely with various indicators of social deprivation and socioeconomic status which are not generally recorded as comprehensively or frequently as mortality

e. SMRs can be calculated using existing administrative data sets for precise geographically-defined populations

It is not suggested that SMRs are a perfect indicator of need for health care. Indeed more research is required to evaluate the validity of the SMR as a proxy for morbidity in Canadian populations. Nevertheless, for the purposes of the present study, and the potential application of the proposed formula on a continuing basis, the SMR appears to be the best available indicator of needs. (See Section 7 for consideration of the sensitivity of the calculated capitation rates to the use of alternative measures.)

c. Cost-adjusted resource requirements

In this stage allowance is made for variations in the costs of providing a given level

of health-care needs. For example, hospitals serving sparsely populated areas may not face the same opportunities for increasing bed-occupancy rates as large urban hospitals. Similarly, community-based services in rural areas may be more costly to provide than in urban centres because of the greater transport costs per unit of service delivery in the total cost of the service.

For each service programme for which cost adjustment is deemed appropriate, a relative cost factor is applied to the needs-adjusted capitation rate calculated in (b) above (see Appendix 5 for the precise mathematical formula).

Before applying the methodology to available data for the study population it is important to emphasize that these capitation rate calculations are independent of the study population's current use of health care. The calculation therefore provides a method of resource allocation which addresses the problem of existing inequalities in access to health care. This contrasts with the alternative approaches to capitation rate calculations used by the Ontario Ministry of Health which are primarily use-based and hence perpetuate any existing inequalities in access.

In terms of the incentives presented by the methodologies, because the capitation rate formula described here is determined by the needs of the population under study, the rate is unaffected by changes in utilization rates that may occur in anticipation of a change to capitation funding.

## Section 6: Results of applying the methodology: A capitation rate for the Fort Frances CHO

## 6.1 Sources and uses of data

In this section we present the results of applying the methodology outlined in Section 5 to the study population. Separate calculations were performed for each service programme and each calculation is described separately.

The size and demographic characteristics of the provincial and study population are based on the 1986 census data (see Section 4 and in particular Table 4.1). Data on programme utilization (i.e., variable U in the formulae in Appendix 5) were provided by the Ontario MoH. Unless otherwise stated, these data are for fiscal year 1987-88, although the calculations could be updated as more recent service utilization data become available. More recent (1988-89) data were available for total Ministry expenditures on each programme (i.e., variable Q in the formulae in Appendix 5; see Table 6.1) and were used in the calculation of baseline, needs-adjusted and cost-adjusted capitation rates (Ontario Ministry of Treasury and Economics, 1989). The use of a different year for the expenditure data is not problematic because the programme expenditures are used merely as a measure of the size of the 'budget'. The provincial utilization rates, on the other hand, are used to weight study population data to determine an appropriate share of the budget, whatever size the budget is.

Some programmes are currently funded in part by Ministries other than the MoH (see Table 6.1). In these cases separate calculations were performed to determine a capitation rate by source of funds. In the results (Table 6.2), the rates are provided in total (i.e., as a global rate) and by source of funds under current funding arrangements.

The calculated capitation rate covers services representing over 95 percent of current expenditure on MoH programmes. Inclusion of programmes in the capitation rate calculations was based on the nature of the service. In general, the programme was included if it provided services to patients directly. Although arguments could be made for incorporating some of the excluded programmes (e.g., capital grants, Northern Area Travel

Table 6.1 **Total provincial expenditures on programmes covered by capitation rate, by source of funds, 1988-89**[1,2]

| Programme | MoH $ | Other Ministry $ | Total $ |
|---|---|---|---|
| Hospitals[3] | 5,039,643,532 | 806,400 | 5,040,449,932 |
| OHIP | 3,936,516,431 | 53,703 | 3,936,570,134 |
| ODB plan | 575,476,229 | 108,519,497 | 683,995,726 |
| Extended Care: | | | |
| Nursing homes | 403,067,918 | | 403,067,918 |
| Chronic Care | 702,998,350 | | 702,998,350 |
| Psychiatric Hosp. | 349,924,313 | 8,793,545 | 358,717,858 |
| Home care | 279,483,878 | | 279,483,878 |
| Ambulance and Emergency:[4] | | | |
| Municipal | 30,055,533 | | 30,055,533 |
| Other | 103,441,120 | | 103,441,120 |
| Community mental health: | | | |
| Community Programmes | 83,388,725 | | 83,388,725 |
| Homes for special care | 87,355,544 | | 87,355,544 |
| Alcohol and drug dependency | 36,781,384 | | 36,781,384 |
| Addiction Research Foundation | 30,338,500 | | 30,338,500 |
| Assistive devices | 49,329,839 | | 49,329,839 |
| Community health laboratories[5] | 28,950,033 | 79,268 | 29,029,301 |
| Total | 11,736,751,529 | 118,252,413 | 11,855,003,942 |
| All MoH programmes[6] | $12,290,422,081 | | |
| Covered by capitation (%) | 95.50 | | |

**Footnotes**

1. Source: Ontario Ministry of Treasury and Economics, 1988-89 Public Accounts of Ontario, Volume 1, Financial Statements and Ontario Ministy of Health personal communication

2. Additional programmes currently funded by the Ministry of Community and Social Services to be considered under the capitation rate, involved 1988-89 total provincial expenditures;

| | $ |
|---|---|
| Child and family intervention | 142,423,223 |
| Child treatment (mental health) | 16,203,911 |
| Residential services (developmental) | 162,660,892 |
| Residential counselling and supportive services | 164,837,514 |

3. Includes acute, rehabilitation and miscellaneous psychiatric units. Excludes nursing homes, chronic care and psychiatric hospitals and homes for special care.

4. An additional $42,584,394 was spent by MoH on the direct provision of ambulance and emergency services.

5. Expenditure figure excludes that part of the programme concerned with laboratory proficiency testing which is not administered locally.

6. In general, programmes were included if they involved direct patient-related services. Of the programmes excluded, the three largest, with the amount (percentage) of total MOH programme expenditure in 1988-89 allocated to each were:

| | $ |
|---|---|
| Clinical education | 163,892,399 (0.67) |
| Operating grants under public health | 137,469,724 (0.56) |
| Capital grants | 103,013,821 (0.42) |

Table 6.2 **Calculated Capitation Rate for the Fort Frances CHO**

| Programme | Source | Age and Gender Adjusted %Prov. Expend. | Age and Gender Adjusted $Per Capita | Need Adjusted %Prov. Expend. | Need Adjusted $Per Capita | Cost Adjusted $Per Capita |
|---|---|---|---|---|---|---|
| Hospitals | MoH | 0.220 | 585.67 | 0.262 | 697.47 | 784.65 |
| | Other | 0.220 | 0.09 | 0.262 | 0.11 | 0.12 |
| OHIP | MoH | 0.206 | 428.36 | 0.264 | 548.96 | 548.96 |
| | Other | 0.206 | 0.01 | 0.264 | 0.01 | 0.01 |
| ODB plan | MoH | 0.253 | 76.91 | 0.324 | 98.49 | 98.49 |
| | Other | 0.174 | 9.97 | 0.223 | 12.78 | 12.78 |
| Extended Care: | | | | | | |
| Nursing Homes | MoH | 0.241 | 51.31 | 0.309 | 65.58 | 73.78 |
| Chronic Care | MoH | 0.239 | 88.75 | 0.262 | 97.29 | 109.45 |
| Psychiatric Hospitals | MoH | 0.203 | 37.52 | 0.193 | 35.68 | 35.68 |
| | Other | 0.203 | 0.94 | 0.193 | 0.90 | 0.90 |
| Home Care | MoH | 0.232 | 34.25 | 0.296 | 43.70 | 49.16 |
| Ambulance and Emergency:[1] | | | | | | |
| Municipal | MoH | 0.204 | 3.24 | 0.261 | 4.14 | 4.66 |
| Other | MoH | 0.204 | 11.15 | 0.261 | 14.26 | 16.04 |
| Community Mental Health: | | | | | | |
| Community Programmes | MoH | 0.204 | 8.99 | 0.194 | 8.55 | 9.62 |
| Homes for Special Care | MoH | 0.223 | 10.29 | 0.223 | 10.29 | 10.29 |
| Alc. and Drug Dep. | MoH | 0.204 | 3.96 | 0.194 | 3.76 | 3.76 |
| Addiction Res.Found. | MoH | 0.204 | 3.27 | 0.194 | 3.11 | 3.11 |
| Asst. Dev. | MoH | 0.204 | 5.32 | 0.261 | 6.80 | 6.80 |
| Community Health Lab. | MoH | 0.204 | 3.12 | 0.261 | 3.99 | 3.99 |
| | Other | 0.204 | 0.01 | 0.261 | 0.01 | 0.01 |
| Total Capitation Rate | | | 1363.13 | | 1655.90 | 1772.28 |

Table 6.2 (con't)

| Programme | Age and Gender Adjusted %Prov. Expend. | Age and Gender Adjusted $Per Capita | Need Adjusted %Prov. Expend. | Need Adjusted $Per Capita | Cost Adjusted $Per Capita |
|---|---|---|---|---|---|
| Additional Services (non MoH): | | | | | |
| Child and Family Intervention | 0.187 | 14.07 | 0.187 | 14.07 | 14.07 |
| Child Treatment | 0.242 | 2.07 | 0.242 | 2.07 | 2.07 |
| Residential Services | 0.204 | 17.53 | 0.204 | 17.53 | 17.53 |
| Residential Counselling | 0.191 | 16.63 | 0.191 | 16.63 | 16.63 |
| Total Including Additional Services | | 1408.88 | | 1709.08 | 1825.83 |

[1] Allocating the $42,584,394 direct expenditure in 1988-89 for ambulance services (i.e. centrally provided and funded, see footnote 4 to Table 6.1) using the same allocation basis as the ambulance and emergency programme expenditure would require an additional $4.59 (age and gender adjusted), $5.87 (needs adjusted) and $6.61 (cost adjusted) per capita.

Grants), no single excluded programme represents more than two thirds of one percent of total MoH programme expenditures. Consequently the calculated rates would not be changed substantially by the inclusion of these programmes. But we do not believe the needs-based capitation rate formulae used here are appropriate for these non-direct patient care services. An additional allocation will be required if these services are to be included in the CHO's mandate, which might be based on the current methods used by the MoH to allocate these particular programmes.

## 6.2 Operations of hospitals

This represents the largest of all MoH programmes and accounts for almost 45 percent of all programme expenditures. It includes services provided in acute care, general and special rehabilitation and miscellaneous psychiatric hospitals but for the purposes of these calculations excludes services provided by chronic care hospitals, which are dealt with separately (see Section 6.5).

Rates of hospital bed days used by age group, gender and ICD category for the provincial population were calculated using utilization data for 1987-88 and published provincial population estimates for 1987 (see Appendix 6, Table A6.1). The capitation rate for age and gender-adjusted resource requirements was then calculated by applying these age group and gender-specific rates to the study population (Table 4.1). This produces a bed utilization figure by ICD category and gender for the study population based on provincial utilization rates (Appendix 6, Table A6.2 columns 1 and 2). This total 'expected' bed days for the study population is then expressed as a per centage of total hospital bed days in the province (12,924,629). This percentage (0.220 per cent in Table A6.2) is applied to the provincial expenditure on the hospital programme (Table 6.1) and the result divided by the study population (Table 4.1) to derive the age and gender-adjusted capitation rate. On the basis of these calculations the capitation rate for hospital services for age and gender-adjusted hospital resource requirements is $585.57 with an additional $0.09 per capita for services currently funded by other Ministries.

Standardized mortality ratios for the non-elderly population were used to adjust this baseline rate for population needs for health care. Separate SMRs were calculated for males and females for each ICD condition (see Section 4 above and Appendix 4). Only where the calculated SMR was statistically significantly different from 100 was the ratio used as a needs weight. Where the calculated SMR did not differ significantly from 100, an SMR of 100 was used (i.e., this assumes the needs of the study population are the same as for the provincial population). Exceptions to this general approach were:

a) Bed days for unspecified ICD conditions were weighted using the SMR for all conditions.

b) An age-standardized prevalence of not being married in the adult population was used as a needs indicator for bed days under ICD 5 (mental disorders). The prevalence of marriage has previously been used as a proxy for needs for hospital-based care for mental disorders (UK Department of Health and Social Security, 1976) based on findings of relationships between the presence of a spouse and the prevalence of mental illness. An alternative approach would have been to use the all condition SMR as an indicator of need for mental illness services. Because the all condition SMR exceeds 100 for both males and females, but the standardized ratio of not being married is less than 100 for males and equal to 100 for females in the study population, the calculated capitation rate is a conservative one.

c) Bed days for ICD condition 11 (complications of pregnancy, childbirth and the puerperium) were allocated using a needs factor given by the product of the standardized fertility ratio (120) and the standardized very low birthweight ratio (84) (see Section 4.10).

These needs weights were applied to the age and gender-adjusted bed days in Table A6.2 to generate needs-adjusted bed days by ICD category and gender (Table A6.2 columns

3 and 4). Total needs-adjusted bed days were then expressed as a percentage of total provincial hospital bed days (0.262 per cent). This percentage was applied to total programme expenditure on hospital services to calculate the needs-adjusted capitation rate in the same way as for the age and gender-adjusted capitation rate. This produced capitation rates for hospital services of $697.47 (Ministry of Health) and $0.11 (other Ministries).

The MoH currently recognizes that there are additional costs of providing hospital care in small communities. Adjustments are incorporated into the guidelines for bed planning numbers, target occupancy rates, and funding in respect of economies of scale and capital grants. On the basis of information provided by the local hospital management, the cost adjustment factors implicit in these differential guidelines were calculated (see Table 6.3). With the exception of the capital grants formula, the implicit adjustment is approximately 12.5 percent, which was used as our cost adjustment factor. Because the cost-adjustment factor was the same for each ICD category, we need only apply it to the total needs-adjusted bed days for the study population. This produced a total cost-adjusted bed days figure of 38,269 (or 0.296 per cent of total provincial hospital bed days). This was then used to calculate the cost-adjusted capitation rate in the same way as for the age and gender-adjusted and needs-adjusted rates. On the basis of this adjustment factor the calculated capitation rate for hospital services based on cost-adjusted resource requirements is $784.65 (Ministry of Health) and $0.12 (other Ministries).

### 6.3 Payments for care provided by physicians under OHIP

This is the second largest of all MoH programmes representing over one third of all MoH programme expenditures. Based on 1987-88 expenditures, by far the largest proportion of this programme (95 per cent) is made up of physician services with much smaller proportions going to optometry (1.84 per cent), osteopathy (0.01 per cent), chiropody (0.17 per cent), chiropractice (2.04 per cent) physiotherapy (0.67 per cent) and dentists (0.21 per cent). Rates of expenditure on physician and practitioner services by age group, gender

Table 6.3 **Identification of cost-adjustment factors implicit in existing administrative guidelines**

| | Provincial guidelines | | % |
|---|---|---|---|
| | General | Northern Ontario | difference |
| 1. Bed planning numbers (per 100 population) | 4.0 | 4.5 | 12.5 |
| 2. Bed occupancy targets (%) | 90 | 80 | 12.5 |
| 3. MoH grants for capital acquisition as proportion of total cost | 4/6 | 5/6 | 25.0 |

Source: Riverside Health Care Facilities Inc.

and type of physician (general practitioner/family physician or other specialty) for the provincial population in 1987-88 were provided by the MoH (Appendix 6, Table A6.3). These rates of expenditure were applied to the study population to generate age and gender-adjusted levels of expenditure on physician services for the CHO. This total 'expected' expenditure on physician services for the CHO is then expressed as a percentage of total provincial expenditure on physician services. This percentage is then applied to the total OHIP expenditure in 1988-89 and divided by the study population to generate the capitation rate. On the basis of these calculations the capitation rate for age and gender-adjusted resource requirements for physician services is $428.36 (plus $0.01 for services currently funded by other Ministries).

All condition SMRs (gender-specific) were used to weight the age and gender-adjusted resource requirements for the needs of the study population. This adjustment for needs produced a capitation rate for physician services of $548.96 (plus $0.01 for services currently funded by other Ministries). Physician remuneration under fee-for-service provision is independent of location, therefore no adjustment was made for relative costs.

### 6.4 Ontario Drug Benefit plan

The Ontario Drug Benefit (ODB) plan is spread across two Ministries, the Ministry of Health (MoH) and the Ministry of Community and Social Services (COMSOC). The MoH portion of the programme covers claims for drugs by persons in particular health programmes (Extended Care, Homes for Special Care, Home Care, Chronic Care), claims for particular drugs (oral hypoglycemics) and claims for drugs for the elderly (age >65).

In practice most of the claimants under the MoH portion of the programme are elderly (97 percent of all claims are by elderly beneficiaries). We therefore used the number of elderly persons in the province as the population denominator and calculated a mean number of claims per elderly person. This rate was applied to the number of elderly persons in the study population to derive an age-adjusted number of claims for the study

population. (No gender-specific utilization data were available. Nor were the data broken down into age groups within the elderly category.)

The age-adjusted capitation rate was then calculated by (i) expressing this age-adjusted number of claims as a percentage of total claims, (ii) applying this to the total MoH expenditure on the ODB plan, and (iii) dividing this calculated expenditure share by the study population (all ages) (Appendix 6, Table 6.4.)

Eligibility for claims under the COMSOC portion of the ODB plan is restricted to recipients of family benefits and general welfare. In this case the provincial population in poverty was used as the population denominator. Using data from the 1986 census, a mean number of claims per person in poverty was calculated and applied to the study population in poverty. No age group or gender-specific data were available. The calculated number of claims was expressed as a percentage of the total number of claims under the COMSOC portion of the plan and used to calculate the appropriate share of the COMSOC expenditure under the plan. This was expressed as a rate of expenditure per capita in the study population (for details of the calculations see Appendix 6 Table A6.4). The calculated age-adjusted (or in the case of the COMSOC portion, income-adjusted) capitation rates for services provided under the ODB plan were $76.91 (MoH) and $9.97 (COMSOC).

The needs-adjusted capitation rates were calculated by applying all condition (both gender) SMRs for age groups 0-64 to the age-adjusted rates. (The rationale for using age group 0-64 SMRs as a proxy for morbidity in elderly populations has already been discussed). This produced needs-adjusted capitation rates for services provided under the ODB plan of $98.49 (MoH) and $12.78 (COMSOC).

As with physician services, no adjustments were made to the capitation rates for relative cost differences.

## 6.5 Extended Care

a) Nursing homes

Data on the number of residents in nursing homes as of March 31, 1988 were provided by the MoH. The data were categorized by age but gender classifications were only available for broad age groupings 0-64 and 65+. The capitation rate calculations were therefore performed for both genders combined.

As with the previous programmes, nursing home capitation rates were calculated by applying provincial age-group specific rates of nursing home residents (see Appendix 6 Table A6.5) to the study population.

The age-adjusted capitation rate for nursing home care was calculated to be $51.31. The all condition SMR was used to weight the calculations for study population needs. This produced a needs-adjusted capitation rate for nursing home care of $65.58.

Cost-adjustment was made on the basis of the assumed higher costs of providing this type of institutional care to an isolated population. The 12.5 percent adjustment factor for hospital services was used. When applied to the needs-based capitation rate, it produced a cost-adjusted capitation rate for nursing home care of $73.78.

b) Chronic Care

This covers services provided in Chronic Care hospitals and chronic care units of other hospitals and falls under the hospital and related services programme. Because expenditures on care provided in chronic care facilities can be identified separately (see Table 6.1), separate capitation rates were calculated for this category of services. The methodology used to calculate the capitation rate was identical to that used for hospital care (Section 6.2 and Appendix 6 Table A6.6).

The age and gender-adjusted capitation rate for chronic care was calculated to be $88.75; the needs-adjusted capitation rate was $97.29, and the cost-adjusted capitation rate was $109.45.

### 6.6 Psychiatric hospitals

The MoH provided data on days of care in psychiatric hospitals by age group and gender for the province. These were used to calculate provincial rates of use by age group and gender (see Appendix 6 Table A6.7) which were then applied to the study population following the same approach as used for the programmes described above. This produced an age group and gender-adjusted capitation rate for psychiatric hospital care of $37.52 (plus $0.94 from other Ministries).

A needs-adjusted capitation rate was calculated by weighting this age group and gender adjusted rate by the Standardized Non-Married Ratio of the study population (see Section 6.2). This produced a needs-adjusted capitation rate for psychiatric hospital care of $35.68.

No adjustment was made for relative costs because psychiatric hospital care for the study population is currently provided outside of the District, i.e., where the provision of institutional care may not be subject to the same relative cost pressures. The additional travel costs of accessing these non-local services, would fall under other (non-capitated) programmes (e.g., Northern Area Travel Grant).

### 6.7 Home Care

Data on home care admissions in 1987-88 by age group and gender were provided by the MoH. These were expressed as population-based rates of use for the province (Appendix 6, Table A6.8) and used to calculate capitation rates following the same methodology as for psychiatric hospital care.

The calculated age group and gender-adjusted capitation rate for home care was $34.25. After adjusting for the needs of the study population, using gender-specific SMRs (all conditions, age 0-64), the capitation rate was increased to $43.70. The 12.5 percent relative cost factor was used to allow for the higher costs of providing home care to a widely distributed population. This produced a cost-adjusted capitation rate for home care of $49.16.

## 6.8 Ambulance and Emergency, Community Mental Health, Assistive Devices and Community Health Laboratories.

With the exception of the Homes for Special Care portion of the community mental health programme (see Section 6.9), data on these services were restricted to the total programme size (i.e., no age group or gender breakdown). Hence, capitation rates were calculated for each programme by applying average expenditure per capita in the province to the study population. (For municipal ambulance and emergency services, number of calls per capita was used) (see Appendix 6 Table A6.9).

All condition SMRs by gender (age 0-64) were used to adjust for needs in the capitation rates for each programme with the exception of the Community Mental Health programmes. For these programmes the Standardized Non-Married Ratio was used to weight capitation rates for needs.

Cost adjustments were made for the community programmes and the ambulance and emergency services on the basis of the additional costs of serving a widely distributed population. A 12.5 percent figure was again used to reflect these additional costs. It is perhaps worth noting that in the case of the ambulance services, the higher cost of gasoline in the northern communities will further increase the costs of serving the population. On the basis of data provided by the MoH, the average cost per kilometre of ambulance travel was approximately 13 percent greater in Fort Frances than in the province in 1987-88. Although the extent to which this additional cost per kilometre represents cost factors

outside of the control of local management cannot be established, it would appear plausible to assume that the additional cost of gasoline represents one element of this additional cost. In so far as no allowance is made for this cost factor in the cost-adjusted calculations, the capitation rates can be seen as a conservative estimate of the resources required to provide the service at a level equal to that provided in the province as a whole.

The calculated capitation rates for these services combined are $24.67 (baseline), $26.22 (needs-adjusted) and $27.29 (cost-adjusted). (Rates for individual programmes appear in Table 6.2). Separate calculations were made for direct expenditure by MoH in ambulance and emergency services (see Table 6.2 footnote 1)

### 6.9 Homes for Special Care

The capitation rate for Homes for Special Care was based on data provided by the MoH on residents of homes by age group using the same methodology as for nursing home care (see Section 6.5 and Appendix 6 Table A6.10). The calculated age-adjusted capitation rate was $10.29. Because clients of these homes tend to be persons suffering from chronic psychiatric conditions (e.g. schizophrenia) who are often unmarried because of their disease, prevalence of spousal support in the study population was not considered to be important in determining need. In the absence of any other indicator of need for these services that was independent of service use, we chose not to weight the capitation rate for needs.

As with psychiatric hospital care, these services are currently provided to the study population outside of the district. Consequently no cost-adjustment was made.

### 6.10 Other non-MoH programmes

Capitation rates were also calculated for four programmes which have no current MoH involvement: Child and family intervention, child treatment (mental illness), residential services (developmentally handicapped) and residential counselling and support.

The calculations were based on the identification of an appropriate population denominator which could be used to calculate provincial mean expenditure rates. These rates were then applied to the study population. No attempt was made to weight these capitation rates for needs or cost-adjustments.

The particular population denominators used were the number of families for child and family intervention services, the number of children (age 0-14) for child treatment services and the total population for residential services for the developmentally handicapped and the population aged 15+ for residential counselling . The calculated capitation rates for these three programmes were $14.07, $2.07, $17.53 and $16.63 respectively (see Appendix 6 Table A6.11).

### 6.11 Global capitation rate

The sum of the calculated capitation rates for each programme produces a global capitation rate for the CHO. This produced baseline, needs-adjusted and cost-adjusted capitation rates of $1363.13, $1655.90 and $1772.28 respectively. If the four additional programmes are included $50.30 should be added to each of the figures, meaning that the total capitation rate for MoH and non-MoH programmes is $1413.43, $1706.20 and $1822.58 respectively.

# Section 7: Summary and Discussion

## 7.1 Needs-based resource allocation: The current study in the context of previous work

The objectives of this research were to develop a needs-based methodology for calculating capitation rates for a CHO, and to apply this methodology to the population served by the proposed Fort Frances CHO. Current levels of expenditure on health-care programmes were used as the framework for the study. Within the framework population-based characteristics (demographic, socioeconomic and mortality) were used to describe the study population in relation to the provincial population, and a proportion of each health-care programme budget was then apportioned to the Fort Frances CHO based on these population characteristics. The approach differs from both current methods of allocating health-care resources in Ontario, and the proposed method of calculating a CHO capitation rate, in that it is independent of current levels of health-care utilization in the Fort Frances population. As such, it avoids 'freezing-in' inequalities of access to health-care that may exist currently in the province.

Although this population needs-based approach to health-care resource allocation has been used in other countries (and also to a limited extent in Quebec), its application has been limited to specific health-care programmes (e.g., hospital-based care in the U.K. and Australia) or subgroups of the population (e.g., Medicare coverage in the U.S.A.). These limited applications of the approach risk generating incentives to off-load health-care needs to other (non-needs-based) budgets (Birch and Maynard 1987) or to reallocate the levels of provision between clients under needs-based capitation funding and clients under other funding arrangements. As far as we are aware, the proposed approach represents the first application of a population needs-based allocation formula to a comprehensive range of health-care services.

Although the application of the derived formula has been restricted to the proposed Fort Frances CHO, the methodology is applicable to other populations. For example, the same approach could be used to calculate capitation rates for other geographically-defined CHOs, or for regions of the province (such as District Health Councils). The methods used

here could not be applied directly to non-geographically defined CHO populations. But population-based data at the small area level could be used with an amended methodology to produce capitation rates based on the needs of the populations from which a CHO membership was drawn.

In addition to considering the wider applications of the methodology, future research should also focus on the validation of alternative measures of need, both of general morbidity and of programme-specific needs for health-care. Such work would be important in refining the capitation formulae derived in this research. However, these validation studies should evaluate the statistical relationships between the proxy indicators and direct measures of population morbidity. Population-based morbidity data have been generated by various population surveys at both the provincial and federal level and could serve as a starting point for this research. These surveys are not generally repeated with sufficient frequency (i.e. annually) and sample sizes are too small to be useful at the small area level. Consequently such survey data are of limited use in allocating resources on an annual basis. But the data generated by the surveys could be used to validate proposed proxy measures for morbidity. The findings of such studies could then be used to develop further research on the collection, analysis and application of population-based measures of morbidity for particular sub-populations or regions.

## 7.2 Sensitivity of the calculated capitation rates

The calculated capitation rates have been presented in a way which highlights the sensitivity of the calculated rates to the three different stages of weighting (see Table 6.2). So, for example, the effects of weighting resource allocations for estimated population needs is to increase the total capitation rate from $1363.13 to $1655.90 (needs-adjusted) and $1772.28 (cost-adjusted), increases of 21.5 per cent and 30.0 per cent.

In arriving at these rates, various assumptions and choices have been made concerning the particular weights to be used. It is therefore important to consider the

sensitivity of the calculated rates to the chosen weighting factors.

a. The effect of native populations on health-care needs:

No attempt has been made to introduce an explicit weight to reflect additional health-care needs of native populations (see Section 4). However, the poorer health status of native populations should be reflected in the mortality rates of the communities to which these populations belong, and no additional needs-adjustments are necessary. But for psychiatric hospitals and community mental health programmes, needs were proxied by the standardized non-married ratio. The calculated needs-adjusted capitation rates for these programmes will therefore be conservative estimates of the study populations needs for these services in so far as native populations are at greater risk of mental illness even after allowing for the prevalence of spousal support.

Because we were unable to find any data which quantified the additional needs of native populations for these services, we did not attempt to further adjust the capitation rate[5]. If, for example, the need for these programmes were, say, 10 per cent greater in the native population than in the non-native population, this would increase the needs-adjusted capitation rate for each programme by 1 per cent (i.e., a 10 per cent increase in the rate or the 10 per cent of the study populations resident on native Reserves).

[5] Data on the prevalence of alcohol problems presented in table 4.2 indicated a greater need for addiction services than in the provincial population as a whole. But because these data were based on non-validated self-reports they were not considered appropriate for use as a weight for need. Nevertheless, the data do suggest that weighting by SNMR alone is unlikely to reflect all the heretogeneity in need across the population.

This would increase the needs-adjusted capitation rate (all programmes) by $0.50 per CHO member.

b. Needs for obstetric care

Needs for obstetric care were proxied by the product of the standardized fertility ratio and the standardized very low birthweight ratio. Very low birthweight (< 1500 grams) was used as an indicator of the need for neo-natal intensive care. However the need for these services is not necessarily confined to babies below 1500 grams. By using the standardized ratio of low birthweight (<2500 grams), a greater proportion of the total need for special care can be captured (i.e., improve the sensitivity of the needs indicator) but at the cost of including more cases for which such special care would not be needed (i.e. reduce the specificity of the indicator). Based on the calculated rates, the study population has a lower rate of low birthweight babies than the provincial population, (after adjusting for maternal age) but an even lower rate of very low birthweight babies (see Table 4.5). The calculated capitation rate for hospital services is therefore conservative in so far as the standardized very low birthweight ratio underestimates the need for special care for babies.

The effect of using the less extreme birthweight as the basis of the needs indicator is to increase the needs-adjusted capitation rate by $2.90 per CHO member.

c. Non-elderly mortality rates

The SMRs used for weighting non-psychiatric service were based on deaths occurring in the non-elderly population. As explained in Section 5, this approach was used because of the way age-specific deaths are weighted in the

calculation of the SMR. In particular, non-elderly SMRs were considered to be a better indicator of morbidity levels and health-care needs for the study population than all-age SMRs. It could be argued that this is inappropriate for those programmes which are concerned largely or exclusively with elderly populations (i.e., nursing home care, home care and the MoH portion of the ODB plan). It might be more appropriate to calculate needs-adjusted capitation rates for these programmes using all-age SMRs, or SMRs based exclusively on elderly deaths.[6] The effect on the capitation rates of substituting these SMRs for the non-elderly SMR is shown in Table 7.1. The effect is to reduce the needs-adjusted capitation rate by $27.71 (1.7 per cent) for each CHO member if all age SMRs are used, and by $36.87 (2.2 per cent) per member if SMRs based on elderly deaths only are used.

d. Adjustments for relative costs

Adjustments were made for the relative costs of providing a given level of service to the study population for a number of programmes. The criteria used in deciding if a cost adjustment was appropriate were:

i. if the local provision of service involved diseconomies in view of the relatively small population being served (e.g., the additional costs of small hospitals)

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[6] It should be emphazised that SMRs are being used as a proxy for the need for health care as opposed to a measure of relative mortality. Problems with using elderly deaths as a proxy for needs for health care in the elderly were outlined in section 3.3

Table 7.1 **Sensitivity of capitation rates to age basis of SMR calculations**

| | Capitation Rates | | |
|---|---|---|---|
| Programme | Using 0-64 SMR | Using all age SMR | Using 65+SMR |
| | $ | $ | $ |
| ODB plan | 98.49 | 85.42 | 80.86 |
| Nursing Homes | 65.58 | 56.85 | 53.87 |
| Home Care | 43.70 | 37.79 | 36.17 |
| Combined capitation rates for these programmes | 207.77 | 180.06 | 170.90 |
| Difference from 0-64 SMR capitation rate | ($) | -27.71 | -36.87 |
| | (%) | -1.70 | -2.20 |

ii. if community based services involved additional time and other resources because of the sparsely distributed population.

Based on these criteria the programmes deemed appropriate for cost -adjustment were; hospitals, chronic care, nursing homes, home care, ambulance and emergency and community mental health programmes. Psychiatric hospitals and homes for special care were not adjusted for relative costs because these services are currently provided outside of the district (i.e. there is no local provision). The additional travel costs of accessing these non-local services will fall under other (non-capitated) programmes (e.g., Northern Area Travel Grant).

Relative cost-adjustments were made by increasing the needs-adjusted capitation rates for individual programmes by 12.5 per cent based on current MoH guidelines (see see Table 6.3). As far as we are aware, this adjustment is not based on any objective assessment of the higher costs of serving small, sparsely distributed populations. But it is interesting to note that based on the data provided by the MoH, the total cost per ambulance mile for Fort Frances under the municipal ambulance programme is 13 per cent greater than the corresponding figure for the province. Although there are various possible reasons for this higher cost of ambulance travel in the Fort Frances district, one factor affecting travel costs is the higher price of gasoline in northern Ontario than in the rest of the province.

The cost per kilometre is just one factor which will affect the relative cost of producing ambulance services. In addition, distance per trip required to provide a service to the same standards as in the province generally, is likely to be greater. Based on MoH data, the average distance per trip in the study population in 1987-88 was 82 per cent greater than for Ontario.

Although these data reflect current use of ambulance services, as opposed to population needs for the service, the 12.5 per cent adjustment for relative costs used to calculate cost-adjusted capitation rates appears to be conservative.

Two other approaches to cost-adjustment were considered. First, population sparsity, measured by the ratio of the area of the population being served to the size of the population, has been used in allocating resources for ambulance services in Scotland. Using data from the 1986 census, the study population has a population sparsity factor nine times that of the provincial population. Although we do not suggest that such a factor should be applied directly to weight the needs-adjusted capitation rates for relative costs, (i.e., increase the needs-adjusted capitation rate by 900 per cent) the population sparsity factor provides further support for the claim that the adjustments we have made to derive cost-adjusted capitation rates are conservative.

An alternative approach considered was to use a regional consumer price index to adjust for relative costs, but this was rejected for both conceptual and practical reasons. In particular

i. the price indices are based on the relative prices of commodities purchased by consumers. But consumers do not purchase directly many of the commodities that are used in the health-care programmes under consideration.

ii. the indices relate to unit prices of a standard collection of commodities. The cost-adjusted capitation rate is concerned with unit prices (as with the price of gasoline in northern Ontario) but also with the additional quantities of commodities that are required to provide the same level of service to the

study population as is provided elsewhere in Ontario (eg., additional beds per capita because of lower capacity utilization, additional trip miles because of a sparsely distributed population).

iii. only a limited number of indices are published (Statistics Canada 1988). The centre nearest to the study population for which an index is published is Thunder Bay, which may not be a good indicator of a price index for Fort Frances. Furthermore, although the indices are useful in comparing the rates of increases in prices between cities over time, they cannot be used as a means of comparing absolute prices between cities.

e. Socio-economic status as a needs indicator

To consider the sensitivity of capitation rate calculations to the use of a mortality index (the SMR) as an indicator of needs, separate needs adjustments were made using a standardized lower education ratio (SLER). This ratio was constructed by taking the ratio of the observed number of adults in the study population who did not have high school graduation to the number expected if age and gender-specific high school graduation rates observed in the provincial population were applied to the study population. The calculated SLERs for the adult study population were 1.18 (males) and 1.16 (females). Needs-adjusted capitation rates were then calculated by applying these weights to the baseline capitation rates. This produced a 'global' (i.e., all programme) needs-adjusted capitation rate of $1590 per person, 3.9 per cent less than the needs-adjusted rate based on SMRs.

Three points are worth emphasizing in considering these data:

i. The education-based adjustments for needs are the same for each programme. Although some refinements could be made in terms of selecting age-group specific SLERS for certain programmes, this would be unlikely to affect the calculations substantially.

ii. The education data are based on self reports at the census, which have not been validated.

iii. Although there is considerable research showing strong correlations between education and health status, we are not aware of any research which suggests that the relationship between the educational achievement of a population and needs for health care is linear. Indeed, evidence suggests that groups with different levels of education have different health problems (Blaxter 1976) indicating a complex relationship between educational attainment and health.

### 7.3 Comparisons with current levels of utilization

As was mentioned above, it was not possible to quantify the current levels of health-care use by the study population for each programme. However the MoH provided data on current use (1987-88 data) by the study population for four programmes: the ODB plan; home care; the municipal ambulance programme; and the community programmes component of community mental health. Comparisons between calculated needs and current use are presented in Table 7.2 based on the percentage of the total provincial programme cost allocated to the study population under two approaches. In the case of the ODB plan and the ambulance programme, current use is expressed in terms of both expenditures and service utilization. So, for example, the study population currently makes 0.236 per cent of the total number of claims under the MoH portion of the ODB plan, and

**Table 7.2** **Comparison of calculated needs-adjusted allocation and current use for the study population.**

| Programme | % of provincial programme funds for study population | |
|---|---|---|
| | calculated needs | current use |
| ODB plan: | | |
| MoH portion | 0.324 | 0.236 (claims)<br>0.223 (expenditure) |
| Other ministries | 0.223 | 0.126 (claims)<br>0.118 (expenditure) |
| Home care | 0.296 | 0.429 (admissions) |
| Ambulance (municipal) | 0.261 | 0.150 (calls)<br>0.272 (miles)<br>0.307 (expenditure) |
| Community mental health: community programmes | 0.194 | 0.320 (expenditure) |

receives benefits costing 0.223 of the total claims benefits paid out. But based on our calculations, the study population 'needs' 0.324 per cent of expenditure under this programme. In other words, the needs based approach increases the share of the ODB plan resources allocated to the study population.

It is important to note that not all programmes for which current use data were available show the same discrepancy between needs and use. On the basis of our calculations, the study population is currently using a greater proportion of total programme expenditures on home care and community mental health programmes but a lower proportion of expenditure on the ODB plan than the needs-adjusted calculations indicate as appropriate.

It may be that some of these discrepancies are expected. For example, because of the sparsely distributed population, home care services may be substituted for institutional care to a greater extent in the study population than in the rest of the province. The implementation of this proposed methodology would not inhibit such substitution taking place in the future because the global capitation rate would not be apportioned to specific programmes. Programme-specific calculations were used only to enable more refined (programme-specific) adjustments to be made. They are not intended to indicate how those resources should be used.

### 7.4 Needs-based and other methodologies

Finally we would emphasize that the calculated capitation rates are the result of applying a general methodology to a specific population. Comparisons with capitation rates calculated for other populations are meaningful only if the same methodology is used. In other words, a capitation rate calculated for a different CHO based on observed use of care by that CHO's population, which produced a similar figure cannot be used to 'validate' a use-based approach to calculating capitation rates.

Only by applying the needs-based methodology to the CHO population and comparing the calculated rate with current use of services or with a use-based capitation rate for the same population can we consider the effect of needs-based resource allocation on the current allocation of health-care resources.

# Appendices

## Appendix 1: Features of alternative risk adjusters from the U.S. research

### a. Non-discretioncy health-care use

Anderson et al. (1986b) suggest that to avoid the manipulation of allocations by providers and beneficiaries, use of non-discretionary health-care services (e.g., trauma-related services) could be adopted as a risk factor. This would exclude the influence of discretionary service use, which has been shown to correlate positively with the numbers of providers (Wenneberg 1984). However, it is not clear what would constitute a discretionary service. Furthermore, if the allocation of resources for non-discretionary services is currently not in line with needs (i.e. unmet needs exist) then a formula based on this method would perpetuate this inequality in access to non-discretionary services.

### b. Self-perceived health status

Thomas et al. (1983) note that self-perceived health status correlates well with the use of ambulatory-care services. Its adoption as a risk factor in resource planning is restricted by practical considerations though. In particular

* at a population level, it is unlikely that appropriate data could be collected with the frequency required (e.g. annually)

* at an individual (or small area) level validity may be a problem if individuals perceive the potential to increase allocations for health care by reporting lower perceived health status.

### c. Functional health status

As with self-perceived health status, this was found to correlate well with ambulatory care use (Thomas and Lichtenstein, 1986). However, as a risk factor for use in resource

allocation it is insensitive, i.e. variations in activities of daily living (ADL) are largely restricted to small sections of the population. Similarly it is relatively stable over time. Hence it cannot distinguish between anything other than extreme differences in population risks in health-care resource requirements. The validity of the ADL index as a proxy for health-care resource requirements is therefore questionable.

A second problem is that at the population level, data are not generally collected on ADLs on a regular basis.

d. Programme entitlement

Disability status is currently used as a risk factor in the Medicare formula. However, its predictive power in explaining variations in health care costs has been shown to be low (Lubitz et al. 1985).

Although the use of programme entitlement as a risk factor has the advantage of being based largely on objective assessments of an individual's status, validity as a risk factor for health-care requirements is questionable. Entitlement to disability benefits is not based exclusively on additional health risks but on other factors such as the reduced income-earning potential and increased costs of daily living.

e. Mortality rates within groups of individuals

Arguments have been made for including group-based mortality rates as a risk factor (Anderson and German, cited in Lubitz et al. 1985). The rationale for the inclusion of mortality rates is twofold: First, observed mortality in a population is a proxy for the general level of morbidity in the population (see the review of U.K. literature in Section 3.3); Second, health-care costs are observed to increase considerably in the last year of life (Lubitz and Prihoda, 1984).

Although the use of an adjusted mortality rate appears to satisfy many of the practical requirements of the ideal risk factor measure, Newhouse (1986) raises two main concerns with its adoption as an indicator of risk. First, where patient and/or provider selection is involved it is difficult to adjust aggregate mortality statistics for the precise 'enrolled population'. Secondly, the use of mortality produces perverse incentives to providers in the form of greater per capita resource allocations in response to greater observed levels of mortality. However, the purpose of a formula is to determine an appropriate allocation of health-care resources. Quality assurance and performance appraisal of the use of those resources are separate problems requiring additional programmes.

## Appendix 2: Alternative Measures of Mortality Rates

In this study, Standardized Mortality Ratios (SMRs) were used to adjust for the relative health-care needs of the study population. The SMR, however, is only one of a number of mortality measures that have been developed. In this appendix we briefly review four of the commonly cited measures and discuss their properties in relation to resource allocation. For a more comprehensive review see Palmer et al. (1979).

### 1. Standardized Mortality Ratio (SMR)

A standardized mortality ratio is calculated as follows:

$$SMR = \left\{\frac{\sum_i m_i P_i}{\sum_i m_i P_i}\right\} x\ 100 = \left\{\frac{\sum_i d_i}{\sum_i D_i}\right\} x\ 100,$$

where

$m_i$ = regional age-specific death rate for age group $i$
$M_i$ = standard age-specific death rate for age group $i$
$P_i$ = regional population in age group $i$
$d_i$ = actual numbers of deaths in age group $i$
$D_i$ = expected number of deaths in region in age group $i$ if standard age specific death rates prevailed

In our setting "region" refers to the study population and "standard" refers to the province.

An SMR reflects absolute differences between the region and the standard populations in age-specific death rates. But rewriting the formula as:

$$SMR = \left\{\sum_i \frac{m_i}{M_i}\left(\frac{M_i P_i}{\sum M_i p_i}\right)\right\} x\ 100,$$

one can see that an SMR is simply a weighted average of the ratio of age-specific death rates, where the weights are equal to the shares of expected deaths in the region in each age group. Therefore, the value of the SMR is dominated by the ratio of death rates in those age groups with the largest shares of expected deaths, most commonly the elderly.

While this is not inherently a problem, it raises two issues when using SMRs for resource allocation. Mortality ratios are used in resource allocation as proxies for morbidity, or underlying need for health-care services. The validity of mortality as a proxy for need varies across age groups, and some have raised particular concern regarding mortality as a measure of need in elderly populations (UK Department of Health and Social Security 1988). Hence, the SMR is dominated by death rates in the age groups for which there is less confidence of its validity as a proxy measure. Second, there is less reliability in the coding of cause of death among the elderly, which raises concerns when disease-specific (e.g. ICD-9 categories) SMRs are used as a basis for resource allocation.

To minimize these problems it has been suggested that SMRs be calculated only with respect to non-elderly age groups or that alternative measures be used.

2. Relative Mortality Index (RMI)

The relative mortality index (RMI) is calculated as follows:

$$RMI = \sum_i \frac{m_i p_i}{M_i} \cdot \frac{1}{P},$$

where

$m_i$, $M_i$, $p_i$ are as above and
P = total regional population.

The RMI is simply a weighted average of the ratio of age-specific death rates, where the weights are equal to the share of the total regional population in each age group. Hence, the value of the RMI is dominated by the ratio of death rates in those age groups

that comprise the largest shares of the population, currently non-elderly age groups.

3. Yerushalmy's Mortality Index (YMI)

To eliminate the "bias" introducted into SMRs and RMIs by giving differential weighting to different age groups, some have argued for the use of Yerushalmy's index, which gives equal weight to each age group. It is calculated as follows:

$$YMI = Ax\left(\sum_i \frac{m_i}{M_i} L_i\right),$$

where

$L_i$ = the length of each age group in number of years

$A$ = $1/\sum_i L_i$

Although the YMI gives equal weight to each group, it raises the question of whether this is an appropriate basis for allocating health-care resources in line with need. It uses no less a weighting system than either SMRs or RMIs, and indeed it could be argued that it is even more arbitrary. It does not circumvent the need to assess what the appropriate weighting scheme is, given the relationship between mortality rates and the need for services in the different age groups.

4. Age-Specific Mortality Ratios (ASMRs)

Some have suggested that rather than using a single index that aggregates over age groups, resource allocation should use age-specific mortality ratios directly. In essence, resource allocation is based on the crude share of all deaths that occur in a region. One disadvantage of this approach is that because the ASMRs are based on the smaller number of deaths that occur in each age group, there is greater chance for variation in their values.

As noted above, any mortality index contains an implicit or explicit weighting scheme

and there is no perfect measure. The choice of index is dictated by the use to which it is being put; in this case to serve as a basis for adjusting for relative needs for health-care resources across regions. We chose the SMR because it has been used in a number of other jurisdictions as the bases for resource allocation and its validity has been tested more than the other measures. To reduce the problem caused by the disproportionate weighting of elderly death rates, we used the SMRs for the under-65 age groups only in our calculations. The sensitivity of the use of SMRs based on this restricted age group is considered in the discussion of the results.

**Appendix 3: Estimating Confidence Intervals for Standardized Mortality Ratios**

We calculated standardized mortality ratios (SMRs) by sex and ICD-9 disease category. Because the number of deaths was small in some gender-disease cells, the associated SMRs are subject to a large amount of chance variation. When basing resource allocation on SMRs it is important to ensure that any SMRs that differ from 100 represent actual, real differences in need rather than random fluctuation. Therefore, we chose to use the gender-disease specific SMRs only in those instances in which a statistical test indicated that the value was different from 100; if the test indicated that we could not reject the null hypotheses that the rate equalled 100, an SMR of 100 was used for that gender-disease cell.

To conduct the statistical test required calculating confidence intervals for the SMRs. Following the work of Armitage (1971) we assumed the observed deaths in each gender-disease cell are drawn from a Poisson distribution. Under this assumption the variance is approximated by:

$$Var\ (SMR) = \frac{O_i}{E_i^2},$$

where $O_i$ is the observed number of deaths in the region and $E_i$ is the expected number of deaths in the region if the standard population mortality rates prevailed. Hence, the 95% confidence interval is simply:

$$SMR \pm 1.96 \left(\frac{O_i}{E_i^2}\right).$$

If the confidence interval did not include 100 then the SMR was said to be statistically different from 100.

Appendix 4. Standardized Mortality Ratios and confidence intevals[1] by ICD category and gender for the study population [2,3]

a) Deaths in age group 0-64 only

| | Male | | Female | |
|---|---|---|---|---|
| | SMR | Confidence interval | SMR | Confidence interval |
| All Conditions: | 127.0 | (126.0, 128.0) | 128.4 | (126.6, 130.2) |
| ICD Category: | | | | |
| 1. Infectious/Parasitic Dis. | 128.9 | (20.3, 237.6) | 163.8 | (-99.2, 426.9) |
| 2. Neoplasm | 105.7 | (102.4, 109.0) | 105.0 | (101.4, 108.6) |
| 3. Endocrine, Nutritional and Metabolic Diseases | 153.4 | (87.5, 219.3) | 96.5 | (35.7, 157.4) |
| 4. Diseases of the Blood | 498.7 | (-1126.4, 2123.9) | 0.0 | (0.0, 0.0) |
| 5. Mental Disorders | 0.0 | (0.0, 0.0) | 211.5 | (-226.9, 649.9) |
| 6. Diseases of Nervous System | 68.6 | (37.9, 99.3) | 91.0 | (36.9, 145.0) |
| 7. Diseases of Circ. System | 120.9 | (117.9, 123.8) | 112.2 | (104.7, 119.6) |
| 8. Diseases of Resp. System | 60.4 | (46.1, 74.7) | 192.7 | (119.9, 265.5) |
| 9. Diseases of Digest. System | 78.0 | (64.8, 91.2) | 182.2 | (123.0, 241.3) |
| 10. Diseases of Genito-urinary System | 73.6 | (-32.6, 179.8) | 241.2 | (-138.9, 621.3) |
| 11. Complications of Pregnancy | | N.A. | 0.0 | (0.0, 0.0) |
| 12. Diseases of Skin | 0.0 | (0.0, 0.0) | 0.0 | (0.0, 0.0) |
| 13. Diseases of the Musculoskeletal System | 0.0 | (0.0, 0.0) | 121.7 | (-168.7, 412.1) |
| 14. Congenital Abnormalities | 35.1 | (23.0, 47.2) | 103.3 | (61.5, 145.1) |
| 15. Conditions of Perinatal Period | 272.9 | (187.0, 358.7) | 111.5 | (62.8, 160.2) |
| 16. Symptoms, Signs and Ill Defined Conditions | 123.9 | (80.9, 166.9) | 224.8 | (83.3, 366.3) |
| 17. Injury and Poisoning | 199.8 | (191.7, 207.9) | 195.9 | (173.1, 218.6) |

b) All Deaths

| | Male | | Female | |
|---|---|---|---|---|
| | SMR | Confidence interval | SMR | Confidence interval |
| All Conditions: | 110.8 | (110.6, 111.1) | 109.9 | (109.6, 110.2) |
| ICD Category: | | | | |
| 1. Infectious/Parasitic Dis. | 56.6 | (35.6, 77.3) | 131.5 | (63.7, 199.2) |
| 2. Neoplasm | 100.2 | (99.3, 101.0) | 98.6 | (97.4, 99.7) |
| 3. Endocrine, Nutritional and Metabolic Diseases | 147.3 | (132.1, 162.5) | 98.9 | (89.3, 108.5) |
| 4. Diseases of the Blood | 74.5 | (52.8, 96.3) | 104.7 | (33.1, 176.3) |
| 5. Mental Disorders | 73.0 | (58.1, 88.0) | 105.0 | (81.0, 129.1) |
| 6. Diseases of Nervous System | 57.6 | (50.4, 64.8) | 97.9 | (83.4, 112.3) |
| 7. Diseases of Circ. System | 111.4 | (110.9, 111.9) | 109.9 | (109.3, 110.5) |
| 8. Diseases of Resp. System | 101.3 | (98.7, 103.9) | 125.8 | (120.3, 131.2) |
| 9. Diseases of Digest. System | 86.0 | (81.0, 91.0) | 146.5 | (136.0, 157.0) |
| 10. Diseases of Genito-urinary System | 65.7 | (55.1, 76.3) | 113.0 | (90.2, 135.7) |
| 11. Complications of Pregnancy | | N.A. | 0.0 | (0.0, 0.0) |
| 12. Diseases of Skin | 0.0 | (0.0, 0.0) | 99.8 | (-95.5, 295.2) |
| 13. Diseases of the Musculoskeletal System | 204.4 | (-.3, 409.0) | 110.5 | (50.7, 170.3) |
| 14. Congenital Abnormalities | 49.3 | (33.4, 65.3) | 95.3 | (59.7, 130.8) |
| 15. Conditions of Perinatal Period | 272.9 | (187.0, 358.7) | 111.5 | (62.8, 160.2) |
| 16. Symptoms, Signs and Ill Defined Conditions | 138.7 | (117.7, 159.6) | 285.0 | (162.5, 407.4) |
| 17. Injury and Poisoning | 173.6 | (168.4, 178.7) | 127.9 | (120.1, 135.7) |

**Footnotes:**

1. 95 percent confidence intervals
2. Bases on population and deaths data for period 1979-1988.
3. Study population proxied by the population of Rainy River District less the population of Atikokan.

Appendix 5

## Mathematical formulae for the capitation rate calculations

1. Age and gender-adjusted resource requirements

$$C_x^E = \sum_k \left( \frac{(\sum_{ij} U_{i,j,k,p} \cdot n_{i,j,x})}{(\sum_{ij} U_{i,j,k,p} \cdot n_{i,j,p})} \cdot \frac{Q_k}{\sum_{ij} n_{i,j,x}} \right)$$

Where $C^E_x$ is the capitation rate for age/gender adjusted resource requirements for community x

$U_k$ is the rate of utilization of programme k

$n_{i,j}$ is the number of persons in age group, i, and gender, j

$Q_k$ is the total provincial public expenditure on programme k

$p$ is the subscript referring to the provincial population

$x$ is a subscript referring to the population in the community of interest

2. Needs-adjusted resource requirements

$$C_x^N = \sum_k \left( \frac{(\sum_{ij} U_{i,j,k,p} \cdot n_{i,j,x})}{(\sum_{ij} U_{i,j,k,p} \cdot n_{i,j,p})} \cdot W_{k,x} \frac{Q_k}{\sum_{ij} n_{i,j,x}} \right)$$

where $C^N_x$ is the capitation rate for needs-adjusted resource requirements for community x

$W_{k,x}$ is the needs index for community x in respect of service k

3. Cost-adjusted resource requirements

$$C_x^M = \sum_k \left[ \frac{(\sum_{i,j} U_{i,j,k,p} \cdot n_{i,j,x})}{(\sum_{i,j} U_{i,j,k,p} \cdot n_{i,j,p})} \cdot W_k \cdot V_{k,x} \cdot \frac{Q_k}{\sum_{i,j} n_{i,j,x}} \right]$$

where $C^M_x$ is the capitation rate for cost-adjusted resource requirements for community x

$V_{k,x}$ is the cost index for community x in respect of service k

**Appendix 6: Provincial utilization rates for health-care programmes used in the capitation rate calculations.**

Table A6.1 **Hospital days per 1000 population in Ontario by age, gender and ICD category, 1987-88 (Non-chronic hospitals)**

| ICD | | 0-4 | 5-9 | 10-14 | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 | 65-74 | 75+ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | M | 43.52 | 8.74 | 5.26 | 8.15 | 13.61 | 15.89 | 14.95 | 18.54 | 33.93 | 88.27 |
| | F | 36.83 | 7.17 | 5.40 | 8.62 | 7.32 | 6.34 | 8.95 | 15.87 | 30.62 | 76.29 |
| 2. | M | 11.42 | 6.19 | 8.47 | 12.65 | 18.18 | 31.99 | 106.89 | 323.63 | 686.71 | 1180.63 |
| | F | 14.50 | 6.47 | 6.30 | 12.74 | 29.80 | 91.12 | 177.57 | 284.26 | 466.28 | 667.58 |
| 3. | M | 8.51 | 5.43 | 8.39 | 7.56 | 8.41 | 13.50 | 28.23 | 55.17 | 105.47 | 216.18 |
| | F | 10.56 | 5.58 | 11.14 | 11.46 | 12.65 | 18.18 | 32.89 | 53.80 | 120.70 | 228.96 |
| 4. | M | 7.32 | 3.04 | 3.63 | 2.56 | 2.08 | 2.20 | 4.18 | 9.67 | 25.42 | 80.32 |
| | F | 5.32 | 3.66 | 3.64 | 3.38 | 2.68 | 2.93 | 5.01 | 9.95 | 25.45 | 79.26 |
| 5. | M | 1.71 | 4.24 | 18.39 | 94.47 | 134.77 | 112.81 | 110.86 | 152.12 | 201.73 | 490.62 |
| | F | 4.03 | 1.40 | 28.57 | 107.90 | 141.79 | 157.02 | 191.23 | 219.21 | 275.51 | 526.03 |
| 6. | M | 42.49 | 14.24 | 16.21 | 16.72 | 17.21 | 24.78 | 38.67 | 80.49 | 193.10 | 407.99 |
| | F | 31.32 | 13.72 | 11.36 | 17.99 | 22.96 | 29.63 | 41.25 | 66.60 | 150.34 | 310.10 |
| 7. | M | 6.49 | 1.96 | 3.11 | 8.04 | 19.22 | 61.69 | 206.40 | 533.21 | 1120.29 | 2408.65 |
| | F | 58.48 | 2.82 | 2.08 | 8.04 | 15.40 | 36.30 | 104.03 | 272.03 | 751.88 | 2214.82 |
| 8. | M | 250.89 | 71.21 | 29.37 | 22.35 | 19.47 | 19.83 | 41.70 | 115.57 | 311.40 | 882.36 |
| | F | 156.77 | 57.76 | 31.80 | 29.75 | 19.03 | 20.06 | 37.44 | 89.03 | 195.37 | 481.71 |
| 9. | M | 57.53 | 18.42 | 21.81 | 41.60 | 54.32 | 78.94 | 138.06 | 231.29 | 345.42 | 600.67 |
| | F | 44.01 | 13.89 | 20.11 | 49.99 | 70.74 | 83.20 | 133.99 | 191.70 | 311.55 | 551.25 |
| 10. | M | 18.71 | 8.66 | 9.72 | 10.43 | 15.29 | 24.66 | 43.87 | 129.39 | 281.22 | 543.15 |
| | F | 13.56 | 8.49 | 7.83 | 44.97 | 89.64 | 118.06 | 114.03 | 101.95 | 132.74 | 199.44 |
| 11. | M | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | F | 0.48 | 0.00 | 1.65 | 320.69 | 639.62 | 114.78 | 1.57 | 0.10 | 0.00 | 0.00 |
| 12. | M | 9.12 | 5.01 | 6.24 | 9.26 | 12.65 | 14.47 | 18.69 | 28.36 | 55.47 | 76.93 |
| | F | 7.76 | 2.62 | 4.44 | 8.01 | 8.22 | 9.49 | 14.59 | 25.16 | 43.53 | 105.57 |
| 13. | M | 6.59 | 11.42 | 14.65 | 25.12 | 36.85 | 50.40 | 71.02 | 112.41 | 186.97 | 262.48 |
| | F | 6.97 | 7.30 | 16.11 | 21.39 | 30.28 | 56.02 | 87.90 | 156.66 | 292.74 | 412.45 |
| 14. | M | 98.29 | 14.81 | 11.52 | 6.26 | 2.60 | 2.80 | 2.19 | 4.64 | 3.91 | 6.27 |
| | F | 93.13 | 12.31 | 9.49 | 5.43 | 3.46 | 3.53 | 4.52 | 4.54 | 8.24 | 3.98 |
| 15. | M | 514.9 | 0.10 | 0.05 | 0.18 | 0.01 | 0.04 | 0.02 | 0.01 | 0.00 | 0.82 |
| | F | 463.19 | 0.02 | 0.01 | 0.12 | 0.10 | 0.01 | 0.01 | 0.09 | 0.08 | 0.89 |
| 16. | M | 61.38 | 14.23 | 12.42 | 11.23 | 15.60 | 25.26 | 43.28 | 78.08 | 145.55 | 366.23 |
| | F | 55.51 | 11.92 | 17.08 | 26.20 | 26.05 | 27.85 | 43.40 | 68.41 | 132.65 | 323.39 |
| 17. | M | 46.56 | 40.44 | 56.08 | 114.50 | 90.20 | 70.53 | 86.09 | 135.69 | 217.82 | 551.81 |
| | F | 33.49 | 24.08 | 26.69 | 46.66 | 39.46 | 40.39 | 59.90 | 113.22 | 263.37 | 1153.11 |
| 99. | M | 662.72 | 7.06 | 7.16 | 15.36 | 17.69 | 21.18 | 35.70 | 86.79 | 168.32 | 381.09 |
| | F | 690.36 | 5.03 | 4.91 | 13.24 | 27.54 | 22.48 | 35.15 | 74.31 | 177.47 | 593.00 |

Table A6.2 **Age gender-adjusted and needs-adjusted bed days for the study population**

| ICD Category | Age and gender-adjusted bed days | | Needs-adjusted bed days | |
|---|---|---|---|---|
| | Female | Male | Female | Male |
| 1. | 160.477 | 186.306 | 160.477 | 186.306 |
| 2. | 1389.890 | 1486.083 | 1459.384 | 1575.248 |
| 3. | 392.899 | 299.422 | 392.899 | 299.422 |
| 4. | 104.198 | 84.936 | 104.198 | 84.936 |
| 5. | 1473.238 | 1087.098 | 1340.647 | 1090.360 |
| 6. | 543.925 | 554.799 | 543.925 | 382.811 |
| 7. | 2432.123 | 2608.962 | 2723.978 | 3156.844 |
| 8. | 843.796 | 1087.864 | 1628.527 | 652.718 |
| 9. | 1209.518 | 1145.462 | 2201.323 | 893.460 |
| 10. | 768.347 | 684.632 | 768.347 | 684.632 |
| 11. | 1517.357 | 0.00 | 1529.496 | 0.00 |
| 12. | 180.970 | 180.740 | 180.970 | 180.740 |
| 13. | 873.605 | 589.040 | 873.605 | 589.040 |
| 14. | 118.344 | 121.927 | 118.344 | 42.675 |
| 15. | 338.230 | 380.326 | 338.230 | 1038.290 |
| 16. | 575.817 | 504.407 | 575.817 | 504.407 |
| 17. | 1306.510 | 1094.859 | 2560.759 | 2189.719 |
| 99. | 1200.067 | 966.811 | 1536.086 | 1227.850 |
| Total | 15429.313 | 13063.670 | 19037.009 | 14779.450 |
| Total both genders: | | 28493 | | 340127 |
| Total (as % of province total) | | 0.220 | | 0.262 |

Source: Authors calculations

Table A6.3 **Cost of Physician Services per capita by age and gender, Ontario 1987-88**

Male:

| Age Group | Family Medicine/ General Practice | Other Specialties |
|---|---|---|
| 0-4 | 156.56 | 149.15 |
| 5-9 | 86.08 | 93.79 |
| 10-14 | 65.82 | 76.67 |
| 15-24 | 71.19 | 79.72 |
| 25-34 | 84.66 | 101.48 |
| 35-44 | 92.49 | 130.01 |
| 45-54 | 105.94 | 180.27 |
| 55-64 | 136.31 | 277.19 |
| 65-74 | 190.71 | 405.99 |
| 75+ | 307.45 | 514.90 |

Female:

| Age Group | Family Medicine/ General Practice | Other Specialties |
|---|---|---|
| 0-4 | 149.84 | 125.21 |
| 5-9 | 82.25 | 76.37 |
| 10-14 | 66.23 | 68.27 |
| 15-24 | 130.73 | 139.53 |
| 25-34 | 170.38 | 239.58 |
| 35-44 | 145.14 | 223.95 |
| 45-54 | 147.69 | 236.16 |
| 55-64 | 154.72 | 264.34 |
| 65-74 | 194.93 | 333.54 |
| 75+ | 316.44 | 391.98 |

Source: Ontario MoH

Table A6.4 **Ontario Drug Benefit plan**

a. Ministry of Health Portion

i) Elderly

Provincial average number of claims per person (age 65+)

$$= \frac{\text{No. of claims}}{\text{Population 65+}} = \frac{27{,}583{,}398}{1{,}029{,}510} = 26.79$$

Study population requirements based on age

= provincial rate of claims x study population age 65+

= 26.79 x 2604 = 69,761

ii) Other MoH

Provincial average number of claims per person (age 65+)

$$= \frac{\text{No. of claims}}{\text{Population 65+}} = \frac{692{,}037}{1{,}029{,}510} = 0.67$$

Study population requirements based on age

= provincial rate of claims x study population age 65+

= 0.67 x 2604 = 1745

Total requirements based on age = 69,761 + 1745 = 71,506

= 0.253 % total claims

Total requirements based on need = requirements based on age x SMR(0-64)

= 71,506 x 1.28

= 91528

= 0.324 % total claims

b. COMSOC Portion

Provincial average number of claims per person 'eligible'

$$= \frac{\text{Number of claims}}{\text{Population in poverty}} = \frac{6,054,446}{1,193,420} = 5.07$$

Total requirements based on prevalence of poverty

= 5.07 x 2076

= 10,523

= 0.174 % total claims

Total requirements based on needs

requirements based on age x SMR(0-64)

= 10,523 x 1.28

= 13,469

= 0.223 % of total claims

Table A6.5 **Number of persons per 1,000 population in Nursing Homes in Ontario by age as at 31 March 1988**

| Age group | Number per 1000 |
|---|---|
| 0-34 | 0.02 |
| 35-44 | 0.10 |
| 45-54 | 0.35 |
| 55-64 | 1.20 |
| 65-74 | 4.87 |
| 75+ | 52.06 |

Source: Ontario MoH and authors' calculations.

Table A6.6 Hospital days per 1000 population in Ontario by age, gender and ICD Category, 1987-88 (Chronic hospitals)

| ICD | | 0-4 | 5-9 | 10-14 | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 | 65-74 | 75+ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | M | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 1.12 | 1.88 | 7.19 | 12.63 | 50.65 |
| | F | 2.10 | 0.00 | 0.00 | 0.40 | 0.31 | 8.85 | 6.05 | 7.35 | 1.47 | 39.30 |
| 2. | M | 0.31 | 0.00 | 0.00 | 0.11 | 0.77 | 1.14 | 2.65 | 21.09 | 90.04 | 291.58 |
| | F | 0.16 | 0.00 | 0.00 | 0.45 | 3.80 | 2.49 | 5.94 | 20.23 | 51.80 | 168.31 |
| 3. | M | 0.00 | 0.00 | 0.00 | 1.04 | 0.00 | 0.00 | 0.90 | 3.98 | 15.83 | 67.26 |
| | F | 0.00 | 1.71 | 0.30 | 0.00 | 0.11 | 0.00 | 0.90 | 3.60 | 14.09 | 113.81 |
| 4. | M | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 1.90 | 4.67 |
| | F | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.10 | 21.49 |
| 5. | M | 1.57 | 0.00 | 4.32 | 0.65 | 3.53 | 3.63 | 4.78 | 21.49 | 94.70 | 553.91 |
| | F | 0.45 | 0.00 | 0.09 | 0.01 | 0.52 | 0.00 | 26.49 | 30.71 | 61.72 | 729.45 |
| 6. | M | 13.57 | 12.45 | 23.11 | 18.16 | 14.42 | 45.50 | 53.94 | 109.22 | 213.13 | 571.06 |
| | F | 1.43 | 0.00 | 6.24 | 2.96 | 21.31 | 45.14 | 138.72 | 156.31 | 212.27 | 598.83 |
| 7. | M | 0.05 | 1.45 | 0.00 | 0.36 | 0.00 | 0.72 | 57.53 | 114.66 | 380.61 | 1534.13 |
| | F | 8.22 | 0.00 | 0.00 | 0.27 | 0.25 | 2.28 | 35.10 | 38.31 | 391.20 | 2159.86 |
| 8. | M | 0.00 | 0.00 | 0.00 | 0.00 | 0.62 | 5.75 | 6.90 | 37.40 | 251.83 | 742.44 |
| | F | 0.00 | 0.03 | 0.00 | 0.10 | 1.91 | 3.93 | 15.99 | 15.18 | 98.25 | 461.95 |
| 9. | M | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.76 | 4.91 | 10.38 | 59.54 |
| | F | 0.00 | 0.00 | 0.00 | 0.00 | 9.79 | 0.00 | 0.16 | 0.24 | 9.12 | 102.37 |
| 10. | M | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 1.43 | 4.81 | 11.54 | 65.08 |
| | F | 0.00 | 0.00 | 0.00 | 0.00 | 0.26 | 0.00 | 0.00 | 9.44 | 9.18 | 46.17 |
| 11. | M | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | F | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 |
| 12. | M | 0.00 | 0.00 | 0.00 | 0.00 | 2.56 | 0.87 | 2.85 | 0.52 | 3.29 | 26.90 |
| | F | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.49 | 0.00 | 3.27 | 2.59 | 27.95 |
| 13. | M | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.10 | 0.05 | 10.87 | 14.65 | 68.23 |
| | F | 0.00 | 0.00 | 0.00 | 0.01 | 0.23 | 3.97 | 1.07 | 40.84 | 45.15 | 243.97 |
| 14. | M | 1.18 | 0.00 | 8.96 | 2.24 | 0.02 | 1.60 | 0.00 | 0.00 | 0.09 | 2.03 |
| | F | 0.64 | 0.00 | 5.94 | 3.43 | 2.25 | 4.91 | 3.17 | 6.53 | 0.18 | 0.91 |
| 15. | M | 2.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.54 | 0.00 |
| | F | 2.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 16. | M | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.93 | 0.31 | 1.13 | 26.66 | 102.36 |
| | F | 0.00 | 0.00 | 0.00 | 0.11 | 0.03 | 3.00 | 6.66 | 9.94 | 23.34 | 208.25 |
| 17. | M | 0.00 | 0.00 | 0.00 | 0.83 | 13.77 | 10.37 | 4.38 | 15.71 | 31.05 | 48.35 |
| | F | 0.04 | 0.00 | 0.00 | 0.26 | 2.88 | 2.05 | 1.31 | 11.81 | 15.43 | 149.65 |
| 99. | M | 4.70 | 1.51 | 1.34 | 3.14 | 0.45 | 17.06 | 20.05 | 24.68 | 103.19 | 492.98 |
| | F | 1.55 | 1.25 | 0.55 | 0.60 | 2.22 | 2.50 | 9.18 | 29.63 | 125.10 | 649.50 |

Table A6.7 **Days of Care per 1000 population in Psychiatric Hospitals in Ontario 1987-88**

| Age Group | Male | Female |
|---|---|---|
| 0-4 | 0.00 | 0.00 |
| 5-9 | 0.00 | 0.00 |
| 10-14 | 10.29 | 4.40 |
| 15-24 | 187.14 | 68.52 |
| 25-34 | 260.89 | 154.76 |
| 35-44 | 184.97 | 111.49 |
| 45-54 | 132.69 | 181.71 |
| 55-64 | 243.75 | 179.68 |
| 65-74 | 316.49 | 223.48 |
| 75+ | 537.96 | 244.47 |

Source: Ontario MoH and authors' calculations.

Table A6.8 **Home Care Admissions per 1,000 population by age and gender, 1987-88, Ontario**

| Age Group | Male | Female |
|---|---|---|
| 0-4 | 5.86 | 5.40 |
| 5-9 | 22.98 | 12.61 |
| 10-14 | 11.51 | 7.55 |
| 15-24 | 4.70 | 4.76 |
| 25-34 | 3.71 | 7.13 |
| 35-44 | 4.62 | 7.68 |
| 45-54 | 8.71 | 12.84 |
| 55-64 | 22.26 | 28.35 |
| 65-74 | 56.28 | 72.12 |
| 75+ | 158.14 | 189.90 |

Source: Ontario MoH and authors' calculations.

**Table A6.10** **Number of persons per 1,000 population in Homes for Special Care in Ontario by age as at 31 March 1988**

| Age group | Provincial Rate |
|---|---|
| 0-34 | 0.06 |
| 35-44 | 0.12 |
| 45-54 | 0.20 |
| 55-64 | 0.57 |
| 65-74 | 1.21 |
| 75+ | 2.17 |

Source: Ontario MoH and authors' calculations.

**Table A6.10** **Number of persons per 1,000 population in Homes for Special Care in Ontario by age as at 31 March 1988**

| Age group | Provincial Rate |
|---|---|
| 0-34 | 0.06 |
| 35-44 | 0.12 |
| 45-54 | 0.20 |
| 55-64 | 0.57 |
| 65-74 | 1.21 |
| 75+ | 2.17 |

Source: Ontario MoH and authors' calculations.

**Table A6.10** **Number of persons per 1,000 population in Homes for Special Care in Ontario by age as at 31 March 1988**

| Age group | Provincial Rate |
|---|---|
| 0-34 | 0.06 |
| 35-44 | 0.12 |
| 45-54 | 0.20 |
| 55-64 | 0.57 |
| 65-74 | 1.21 |
| 75+ | 2.17 |

Source: Ontario MoH and authors' calculations.

Table A6.11 Rates of Expenditures on COMSOC programmes on Ontario, 1988-89

| Programme | $ |
|---|---|
| Child and Family Intervention (expenditure per family) | 58.01 |
| Child Treatment (expenditure per person 0-14) | 8.56 |
| Residential Services (expenditure per person) | 17.24 |

Source: Ontario Ministry of Treasury and Economics (1989) and authors' calculations.

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