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NEEDS-BASED PLANNING OF HEALTH CARE:
A CRITICAL APPRAISAL OF THE LITERATURE

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EXECUTIVE SUMMARY

In this report we consider the case for using a population-needs based approach to the planning and allocation of health-care resources in Ontario. In section 1 the needs-based approach is contrasted with systems of allocation used currently in Ontario. These existing systems tend to allocate resources on the basis of past levels of service utilization which, in turn, are determined largely by historical patterns of distribution of health-care providers and facilities. Under these systems, any existing inequities in access to care are perpetuated. In contrast, the needs-based approach relates resource allocations to characteristics of the population being served on the basis of health risks, morbidity and the need for health-care services. Consequently the link between current use of future allocation is severed and a population's current level of service utilization. The needs-based approach therefore provides a financial framework for directing (or targeting) resources to populations with greatest need and hence allocates the capacity for caring in a way which promotes the efficient and equitable use of limited health-care resources.

In section two the literature on population-based measures of health status and the relationships between these measures and other sociodemographic and socioeconomic indicators is reviewed. Because health care is not provided as an end in itself, but as a means to producing improvements in health status or health-related quality of life, then the need for health care is not the same as the presence of morbidity. In the context of Canadian health policy, health care is needed only where there is an expectation that the utilization of such care would improve health status or health-related quality of life. Accordingly measures of morbidity may not be valid indicators of relative health-care need.

Several characteristics are identified as required in an indicator, or proxy measure, of health-care need. These range from statistical characteristics of validity (indicator value responds to changes in need), to practical issues of administrative feasibility, (data are already available and updated at regular and frequent intervals) and
resistant to manipulation by interested parties (low 'gameability').

In section three both direct and indirect approaches to measuring relative health-care need are considered. Particular attention is paid the whether the measures are a valid indicator of need for care, the form of the relationship between the measure and health-care need (i.e. the relationship linear), and issues concerning the combination of different measures to produce a single indicator of need. Little attention has been paid to these issues in the literature and applications of the needs-based approach. To date, the Standardized Mortality Ratio, as a measure of premature mortality; appears to come closest to meeting the required characteristics, although its validity as an indicator of relative need requires replication using Canadian-based data and for services other than acute care.

Section four outlines several issues concerning the implementation of a needs-based approach, covering technical issues (the availability and use of appropriate data, the identification of appropriate planning populations and the management of patient flows (across population boundaries), organizational issues (providing the appropriate levels and quantities of skills to support the approach, the method and rate of implementation of needs-based planning from a use-based system), institutional issues (the impact of the adoption of a needs-based approach on the population, health-care providers, employers, the Ministry of Health and other Ministries) and contextual issues (the scope of the use of a needs-based approach in terms of services and populations to be covered, and the planned levels of resources to be allocated to health care in total, within which the needs-based approach might be used). Experiences from other jurisdictions are drawn upon to illustrate many of these issues.

In section five several research questions are identified, the answers to which would enhance or support the application of a needs-based approach. In particular more attention should be paid to the identification and validation of more refined measures of relative health-care need at the population level. It is suggested that existing data sources might be used to address this issue. Similarly attention should be paid to the
identification of the determinants of variations between populations in the cost of providing a given level of care and hence the resource requirements to meet health-care needs. Finally it is emphasized that the needs-based approach provides a framework for allocating resources (i.e. inputs) efficiently and equitably between populations. How these resources are used within the population requires further attention which compares the levels of resources used with the outputs (i.e. health status improvements) produced (i.e. performance appraisal). In other words, the needs-based approach alone, is necessary but not sufficient to ensure the efficient and equitable use of health-care resources.

It is emphasized that the needs-based approach is proposed here, not as an ideal system of resource management, but as a method of resource allocation within a jurisdiction which provides a framework (or geographical allocation) consistent with the fulfilment of the objectives of health-care policy in Ontario, and which represents a considerable improvement upon the current system in place.
SECTION 1
WHY NEEDS-BASED PLANNING?

1.1 Introduction

"... the primary objective of Canadian health policy is to protect, promote and restore the physical and mental well-being of residents of Canada and to facilitate reasonable access to health services without financial or other barriers."

Canada Health Act 1984.

A major challenge for health-care policy-makers in Ontario is to identify and implement methods of resource planning and allocation which are consistent with this primary objective. It is important to identify at the outset that the allocation of resources (or more precisely public expenditures giving command over inputs) between health care and other services (i.e. setting the level of expenditure on health care) and the allocation of resources (or expenditures) within health care are fundamentally different issues. The first concerns how much is to be allocated to health-care provision, i.e. inputs, the second concerns how those inputs are to be used in order to produce outcomes. In this report we are concerned exclusively with the latter issue and in particular with the allocation of health-care resources between populations. How these resources are then used to serve populations is an additional issue which requires separate consideration (see section 5).

1.2 Options for Resource Allocation

Existing allocations of health-care resources in Ontario, are determined largely by past resource allocations and by the distribution of health-care facilities and providers of health care. For instance, hospitals are funded on the basis of global budgets which are determined, by and large, by previous years' expenditures. In setting these budgets, little 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 alternative funding arrangements are currently used, such as capitation for Health Service Organizations (HSOs), the allocated funds are determined directly from utilization under fee-for-service provision (Birch et al., 1990). As such, resource allocation is determined by the number and type of services provided, which in turn, are related largely to the number and type of physicians. But the distribution of physicians may not correspond to the distribution of population needs for health care.

An alternative approach, which is the focus of this document, is to allocate health-care resources in accordance with the relative levels of need for health care among populations.

1.3 What does needs-based planning offer?

The meaning of reasonable access and need for health care.

In the context of Canadian health policy, health-care services are not viewed as ends in themselves but are identified as a means of protecting, promoting or restoring health. Hence reasonable access to care (or access without financial or other barriers) does not imply availability in response to demands for care. On the contrary, it implies that services should be available when the use of such services would (or might be expected to) lead to improvements in health status. To this end, we can define need for health care to mean an ability to benefit from health care. Health care which is provided without any expectation that it would "...protect, promote and restore..." health would appear to lie beyond the boundaries of the Canada Health Act and hence the medicare system.
Sharing resources for health care

It is perhaps widely accepted that a society could never reasonably expect to meet all needs for health care, i.e. continue to provide care to the population until no more benefit could be produced, no matter how small, from any further service provision. Moreover it is not clear that a society would ever want to meet all such needs. At some stage the expected benefit from further health-care provision may be so small, although positive, that what has to be given up to provide that extra care (i.e. the 'opportunity cost') is of more value to society than the small benefits produced. Providing such care, although effective medicine, would be inefficient, i.e., 'flat of the curve' medicine (Enthoven 1980, Evans 1984).

If all needs cannot or should not be met, then some basis for sharing resources between needs is required. Existing methods of resource allocation, which are largely inherited from the pre-Medicare era, tend to share on the basis of existing capacities to provide care, irrespective of the relative levels of need for care and hence the expected impact on population health status. But sharing resources among populations on the basis of relative levels of need incorporates aspects of both efficiency and equity in health-care provision, as follows:-

Efficiency: Populations with greater health-care needs, and hence greater potential for health status improvements, are allocated greater levels of resources.

Equity: Populations with equal needs receive equal allocations of resources ('horizontal equity') but populations with unequal needs receive unequal allocations of resources ('vertical equity').
1.4 The Mechanics of Needs-Based Planning of Health Care

There are two broad approaches to needs-based planning of health-care;

The absolute-needs approach: this takes as its goal a given (or target) level of population health status, which may be full health, and attempts to quantify the health-care resource requirements to produce that target level of health status.

A particular feature of this approach is the absence of any consideration of resource constraints or cost-benefit considerations of health status improvements at the margin. The calculated resource requirements, when aggregated across communities are therefore likely to far exceed existing expenditures on health care and accordingly the approach has limited practical relevance.

The relative needs approach: this considers the relative levels of population health status among communities and attempts to allocate a given level of health-care resources, which might be the existing level of health-care resources, in accordance with differing levels of population health status. A particular feature of this approach is that it is consistent with any level of allocation of resources to health care.

The purpose of this report is to critically appraise the literature on needs-based planning as a policy-relevant methodology for allocating health-care resources. Accordingly we shall focus attention exclusively on the relative needs approach.

The objective of the relative needs approach is to calculate population-specific shares of the total health-care budget based on the relative needs of the populations. The basis of these calculations is:
* assume an equal per capita population need for health care and calculate population based shares of the total allocation of resources to health care.

* relax the assumption of equal per capita population need by adjusting the population shares according to the different age and gender mix of populations (e.g., communities A and B might have the same size of population but A has more elderly persons but fewer women in childbearing years). This would generate an 'age and gender'-adjusted resource share.

* further relax the assumption by adjusting for the different health risks of populations within age and gender groups (e.g. the population of community A might be at greater risk of respiratory conditions because of environmental and/or lifestyle factors than the population of community B). This would produce a 'health risks'-adjusted resource share.

* finally adjust the needs-based shares to allow for the different capacities of communities to provide health-care services from a given allocation of resources (e.g. it might be more costly to provide a home care service in a rural area because of (a) the greater distances travelled per client and/or (b) the higher price of gasoline). This would produce a 'capacity-to-provide'-adjusted resource share.

Each of these stages is cumulative, i.e., it adjusts for the particular factor of interest in addition to all previous adjustments. Hence, the calculated 'capacity-to-provide'-adjusted shares also incorporate the differing age and gender mixes and health risks. An example of the application of this methodology is given in Birch et al. (1990) and in Eyles et al. (in press).
A methodology for making these adjustments is illustrated and applied to the population of Ontario at the county level in a companion paper. In general, adjustments are based on the findings of empirical studies which identify the underlying relationships of interest (e.g. the relationship between age and gender and the need for health-care services). In this report we focus attention on

a) the nature of the data requirements to support the use of needs-based planning (sections 2 and 3).

b) issues concerning the implementation of needs-based planning of health-care resources (section 4).

c) areas for which further research would appear to be productive in supporting and enhancing a needs-based planning approach (section 5).

1.5 Summary

Although the objectives of the Canada Health Act may be laudable, the adoption of the objectives has not been accompanied by structural mechanisms to promote the achievement of these objectives. By and large, pre-existing methods of resource allocation, which emphasize past use of services as a basis of planning for current provision of services, have been maintained. No mechanisms currently exist which automatically direct resources to greatest needs. As such the allocation of resources is likely to reflect more historic distributions of populations and the locational preferences of providers than the health-care needs of populations, and perpetuate any existing inefficiencies and inequities in the allocation of resources between populations.

Needs-based planning is an approach to resource allocation in which resources are directed towards (or shared between) populations. The size of each population's allocation is determined independently of existing levels and mix of service utilization by that population, and relates to the characteristics of each population in the context of the corresponding characteristics of the entire (e.g. provincial) population.
SECTION 2

POPULATION-BASED INDICATORS OF HEALTH STATUS: WHAT DO WE KNOW AND WHAT DO WE NEED TO KNOW?

2.1 Population-Based Studies of Health Status in Canada

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 Canada 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 decreases in the differences in life expectancy at birth between the highest and lowest income quintiles between 1971 and 1986, relative mortality (lowest compared to highest income quintile) at most ages changed only slightly over this period. Furthermore, the socioeconomic differences are found to persist even after controlling for age, race, gender, baseline health status, depression and certain lifestyle behaviours such as smoking, alcohol consumption and physical activity (Hertzman 1990).
In terms of risks to health, 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), while persons whose native tongue is other than English or French were less likely to be happy, have poorer self-rated health, more activity limitation, and more negative attitudes to diet and nutrition (Wilkins 1988, Adams and Wilkins 1988)\(^1\). 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 readdressing 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).\(^2\)

\(^{1}\) These findings are by no means unique to Canada but have been observed in many different countries (see Whitehead (1987) for a survey of the international findings on inequalities in health).

\(^{2}\) One exception to this that we are aware of is the use of an income-based measure of socioeconomic status in some regions of Quebec to weight for different needs for home care services between districts of the planning authority (Secteur des services multiciienteles de premier ligne 1989).
2.2 The Application of Population-Based Health Status Indicators to Resource Allocation

Before considering how population-based indicators of health status can be incorporated into a needs-based methodology for resource allocation, it is important to identify the statistical properties required for a 'good' indicator (Bergner and Rothman 1987). In particular, in the absence of any gold standard measure of population health status, or more precisely, population need for health care, it is important that the chosen indicators of (or proxies for) health-care need are valid, reliable and responsive.³

Validity is defined as the ability of an indicator to measure what it is intended to measure. In the absence of a 'gold standard' measure of the phenomena of interest validity is usually assessed in terms of the direction and magnitude of the correlation with another measure or measures for which an a priori theoretical relationship has been established.

Reliability is a measure of the extent to which an indicator is reproducible, or gives the same results, over different situations (Streiner et al. 1989). Reliability is measured by the proportion of variability in the indicator (across repeated measurements) that is caused by 'true' variability in the underlying phenomena being measured.

Responsiveness is the extent to which an indicator value responds to changes in the underlying phenomena of interest.

³ See Appendix 1 for a fuller description of these properties.
Although there is considerable research literature on the relationships between health status and various indicators of socioeconomic status, the properties of these indicators as proxies for need for health care remain largely unexplored (see section 3).

2.3 Health Status and the Need for Health Care

Need for health care is here interpreted in terms of ability to benefit from health care as implied by reducing the risks of deterioration in health status (or health-related quality of life) or improving the probability of improvements to health status (or health-related quality of life). But this introduces an important distinction between indicators of health status and indicators of need for health care. Some illnesses might not be affected by health-care interventions, or such interventions might be inefficient (e.g. because the conditions are self-limiting such as coughs and colds). In these instances sub-optimal levels of health status do not translate into needs for health care.

In choosing between alternative indicators of health status for the purposes of allocating health-care resources among populations, we are less concerned with how well the indicator represents population differences in health status per se, and more concerned with how well it represents population differences in conditions and health risks which are amenable to health-care provision. But this implies that we need to be concerned, not only with the statistical properties of the indicators used, but also with how they are applied to develop population-needs based allocations. Anderson et al. (1986) identify five criteria for an 'ideal' formula for determining health-care resource allocations. In particular

i. the calculated allocations should accurately reflect the costs of the predictable health-care needs of the subjects,

ii. the costs of the predictable health-care needs should vary as a function of characteristics of the subjects,
iii. the derived formula should be capable of being used for all subjects,

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

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

In section 3 we consider various types of indicators of, or proxies for, the need for health care, paying particular attention to the indicators' ability to satisfy these criteria.
SECTION 3:

POPULATION-BASED INDICATORS OF HEALTH-CARE NEEDS:
WHAT IS AVAILABLE AND WHAT IS APPROPRIATE?

3.1 Introduction

In this section we evaluate the use of various measures of health status and
risks to health as indicators of health care need. Attention is focused on how each
measure relates to health-care need. This is of particular importance because

* no prospective measure of health-care need exists. But the challenge to health-
care planners is to allocate resources in accordance with such needs.

* population-based planning requires the aggregation of individual needs at the
community level.

* in the absence of prospective measures, it is necessary to rely on retrospective
indicators which relate to past experiences and behaviours.

Health-care needs may be measured directly or indirectly. Direct measures are based
on the quantification of the precise health-care services required to improve the
health status of an individual or group and, hence, rely on assessments of health-care
professionals. Alternatively, need for health care can be estimated through population
self-assessments. Although these self-assessments represent the most informed
indicator of need, in terms of personal health experiences, individuals are necessarily
limited in their ability to assess the appropriateness of health-care interventions for
dealing with health problems. Indirect measures of need for health care infer need
from some other health or social attribute, such as mortality or social deprivation.
3.2 Direct Indicators of Need for Health Care

Health-care utilization data

Health-care utilization data are often cited as indicators of need for care. Because the physician is, by and large, the gatekeeper to health-care utilization, use of care can be interpreted as a professionally-assessed need for care. But the utilization of health-care services is influenced by the availability and accessibility of health-care providers which may differ between populations. Hence health-care use may differ among individuals or populations with the same health risks and health-care needs, and individuals with the same level of utilization may have differing needs for care (see Andersen and Newman 1973, Beland 1988, Broyles et al. 1983, Evasewick et al. 1984, Feidler 1981, Hart 1974, Hershey et al. 1975, Hulka and Wheat 1985, Manga et al. 1987, McKinley 1972, Mechanic 1979, Muller 1986, Starfield et al. 1985, Wolinsky 1978).

The application of health-care utilization data as an indicator for health-care needs therefore risks perpetuating any existing inequalities and inefficiencies in the allocation of health-care resources. Hence measures of service utilization are inappropriae as indicators of need for care at the population level.

Case registries

For specific illnesses, the experiences of a population have been captured in the form of registries (e.g. cancers, birth defects, notifiable diseases). Gandy (1979) suggests that registry data provide reliable and valid indicators of morbidity even when compared with mortality but they do not relate directly to needs for health care. By counting cases, not contacts, registries are population-oriented but they depend on the health-care system for the identification (diagnosis) of cases and are therefore not independent of supply. Furthermore, extending the registry system to cover a broader range of conditions which could benefit from health care would be costly, administratively difficult, and may generate difficulties in classification and coding.
Population-based surveys

Surveys are a direct way of measuring the need for health care. They can examine a range of topics from the general needs of specific groups to particular health-care needs. At the general level, Bebbington and Davies (1980a,b) estimated the absolute health-care needs of the elderly based on professional assessments of services required to respond to self-reported health and social welfare problems. This approach has major data requirements and is more concerned with planning for absolute needs of a population as opposed to relative needs between populations.

Sample surveys can however provide some indicators of health-care need. Such surveys generally rely on self-reports of ill-health. They often take the form of general health questions, and disease-specific and generic composite health measurement instruments (see McDowell and Newell 1987). The composite measures can discover various dimensions of health or well-being such as physical, psychological and social functioning, levels of pain and well-being, mobility and activity, and self-reported symptoms. While these measures of health status may provide useful indicators of need for health care in general, indicators of long-term and chronic health problems may best be discovered by the Activities of Daily Living scale (ADL) (see Rowland 1989).

The administrative feasibility of sample surveys is limited by the high cost of such surveys and problems with the generalizability of the findings to the wider population (i.e. sample size problems). They are also potentially 'gameable' in that the measures may be influenced by the actions of those who stand to gain by manipulating the data (e.g. over reporting of conditions in order to increase a population's share of resources). In terms of both validity (does the instrument mean what it is supposed to?) and reliability (can the measurement scores be replicated?) most of the general health measures perform promisingly. The following indicators have been particularly successful in these respects:
- the general health questionnaire to discover psychological well-being (see Goldberg and Hillier 1979, Tarnopolovsky et al. 1979).

- the life satisfaction index to measure quality of life and life satisfaction (see Neugarten et al. 1961, Connidis 1984).

- the Nottingham health profile (see Hunt et al. 1981) and the sickness impact profile (see Bergner et al. 1981) to measure self-reported morbidity and health state.

But the relationship of these indicators to need for health care must be inferred from the level of identified sickness in the population (i.e. the indicators are concerned primarily with aspects of health status not needs for health care). Other problems with the use of sample survey-based self reports of health status as indicators of health-care need include:

* comparisons of self-reports with medical records shows an underreporting of ill-health conditions (Cleary and Jette 1984, Hayes et al. 1990); ethnographic studies demonstrate that some people visit physicians only with 'proper cause' or report no perceived morbidities, again potentially underreporting the need for health care (see Eyles and Donovan 1986, 1990).

* recall of prior episodes of illness can be affected by the interview situation, current perceived health status, age, gender and social support and socio-economic status (Aneshensel et al. 1987).

* self-reports can vary significantly from day to day.

* differences in question wording and ordering can limit comparability between surveys undertaken at different times and in different places and hence generate inconsistent indicators of health-care needs.
there has been little assessment of the validity and reliability of the indicators at the small area level.

Nevertheless it should be recognized that there is no 'gold-standard' measure of health-care need against which to compare those survey-based indicators.

In summary, population sample surveys can be used to provide a direct measure of self-assessed need for health care. Many of the indicators so derived have been shown to be statistically valid and reliable as indicators of population morbidity. What they lack in administrative feasibility, they recoup in validity. Although expense precludes the undertaking of frequently repeated representative population sample surveys for use in health-care resource allocations, the derived indicators could be used to validate other proxy or indirect indicators of the need for health care (see section 5).

3.4 Indirect Indicators of the Need for Health Care

Need for health care can be implied from indirect measures of need based on observed relationships, which need not be causal, between the indicator and health-care needs at other points in time, or for other levels of population. We shall consider two major categories of indirect indicators: (1) mortality, and (2) socio-demographic and socio-economic measures.

Mortality

Mortality has the advantage of administrative feasibility (the data are already collected on a continuous basis for the entire population). It is a valid and reliable, albeit extreme, measure of health status. Death certificates include information on age, gender, area of residence and cause of death and are filled out for all deaths in Canada. But to what extent does mortality observed in a population reflect need for health care in that population? The validity of mortality as such a measure has been much debated (see Mays 1987, Mays and Bevan 1987) and several
problems have been identified. In particular:

* advances in public health, sanitation and medicine have altered the main causes of death in developed societies so that the value of mortality as a measure of health status within a population may have diminished (see Forster 1977, Hansluwka 1985).

* health problems vary considerably in their severity (case fatality), but low case fatality does not always mean that a particular illness is less disabling and hence less in need of health care (Ferrer et al. 1977, Fox 1978).

* the correlation between mortality and non-serious illness is often negligible (see Townsend et al. 1986).

* the consistency and strength of the relationship between mortality and morbidity varies across socio-economic groups, causes of sickness and death, and age group (see McKinlay and McKinlay 1986, Syme and Berkman 1986).

But such difficulties do not mean that mortality should be completely rejected. On the contrary, these limitations pertain essentially to the problem of mortality as an indicator of morbidity. But rates of mortality, when adjusted for the age and gender mix of a population in the form of standardized mortality ratios (SMRs)\(^4\) have been found to be a good indicator of the need for health care. In particular:

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\(^4\) The SMR expresses the observed number of deaths in a population as a percentage of the number of deaths expected if the population experienced the same age and gender specific rates of death as the 'parent' population to which it belongs. So an SMR of 120 indicates that mortality in the population was 20 percent higher than expected on the basis of mortality experience in the parent population (see Appendix 2 for a discussion of SMRs and other methods of adjusting crude mortality rates).
* Mortality measures avoid contamination of the needs indicator by the availability of health-care resources.

* Mortality has been found to correlate significantly with those types of morbidity that are associated with considerable and continuing needs for health care (e.g. chronic and permanent sickness and conditions with high case fatality rates) (see Forster 1977, Palmer 1978, Ashley and McLachlan 1985).

* These correlations have been observed even at the small area population level (Brennan and Clare 1980, Townsend et al. 1986).

* Other indicators of need can be used instead of mortality for conditions with low case fatality rates or poor correlations between mortality and prevalence.

However Bennett and Holland (1977) argued that

- the main chronic conditions exhibiting poor correlations show little regional variation.

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

So SMRs appear to be a good proxy for health-care needs for those conditions generating major health-service requirements. Furthermore:

* Although the precise relationship between SMRs and need for care has not been explored widely, Brennan and Clare (1980) observed a linear relationship between SMRs and 'permanent sickness' and 'sick and unemployed'.
* SMRs calculated on the basis of deaths in all age groups may represent a 'biased' indicator of need for care because of the relative weights attached to different age groups (see Appendix 2 and Sanderson 1979). In particular, 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). Consequently, SMRs based on age groups 0-64 have been found to correlate more closely with population need for health care (Carstairs and Morris 1989a,b,c) and have been used in, or proposed for resource allocation formula in other jurisdictions (Mays 1989, Carr-Hill 1989, Birch et al. 1990). It may be further argued that deaths in the 0-64 age cohort represent premature mortality and hence provide a potentially useful measure of health care needs.

* the reliability of SMRs may be increased by combining mortality data for several years (see Holland et al. 1980).

* the reliability of mortality statistics is based on autopsy returns and death certificates. Although some doubts have been cast over their accuracy (e.g. Abrahamson et al. 1971, Cole 1989, Moriyama 1989) for some causes of death e.g. deaths of neonates, cirrhosis, suicide), combining International Classification of diseases (ICD) categories is a possible solution (Palmer 1978).

In summary, mortality rates, adjusted for age and gender, provide an administratively feasible, valid and reliable proxy for need for health care. They are particularly powerful for those conditions for which illness status and risk of death are strongly related and they correlate significantly with rates of chronic and permanent sickness which are associated with considerable and continuing needs for health care.
Sensitive selection of condition-specific SMRs is required for needs-based allocation for particular programs so that there is an appropriate match between the mortality measure and the conditions that the program is meant to target. There are some programs for which SMRs seem unsuitable, namely obstetrics and gynaecology, mental health and prevention and health promotion programmes. Although some (e.g. Forster 1978, Sanderson 1979) have argued that SMRs are potentially 'gameable' in that providers are financially rewarded where SMRs are higher, manipulation of SMRs to increase allocations would require unethical as well as inefficient behaviour. Such 'gameability' is implausible in the Canadian health-care system.

Socio-demographic characteristics

Inequalities in health status tend to follow variations in age, gender and ethnic background. For these measures to be valid proxies of health status and the need for health care, they should be strongly and consistently correlated with illness experience in the community. There is little evidence on ethnic differences (see Rootman 1988), although the Health Promotion Survey found that those with a home language other than English or French tended to have poorer self-rated health and more activity limitation (Health and Welfare Canada 1988, Wilkins 1988). Native Canadians are also seen as having greater needs for health care (see D'Arcy 1989) but there has been no attempt to determine how such findings may be systematically incorporated into a needs indicator.

More is known about age and gender differences. Among adults, a clear gradient of poorer health and increased risk of death or institutionalization with increasing age is evident (see Townsend and Davidson 1982, Carter and Peel 1976, Wilkins and Adams 1983). Among children, particularly in the first year of life, the reverse is true. But there is a well-established pattern for the relationship between age and health in developed societies.
Gender differences are also well documented. The existence of excess male mortality is quite consistent, although not culturally universal (see Waldron 1986). With morbidity, men tend to exhibit better health than women even when adjusting for age. This is usually attributable not only to greater actual sickness among women but also the greater tendency of men to underestimate prior illness and to make less frequent visits to physicians than women (see Syme and Berkman 1986, Waldron 1986). But it must be noted that all sub-populations will vary by age and gender. Given this, age and gender differences can and are used as ways of calculating baseline allocations of resources which can then be further adjusted for variations in health risks and health-care needs, independent of age and gender, and hence for population needs (as in SMRs) (see Birch et al. 1990).

Other socio-demographic measures may have limited use as needs indicators for specific programmes or parts of programmes. For example:

* marital status - the presence of a spouse is often associated with the presence of emotional and social support which may reduce the risk of mental illness and hence the need for mental-health care (see Berkman and Smye 1979, House et al. 1988). Rates of mental illness have also been found to correlate with gender, age, living arrangements, socio-economic status, ethnicity and degree of urbanization (see Giggs 1988).

* fertility - the rate at which women give birth (live and still) and the incidence of low birthweight babies may affect directly the need for health care. Birch et al. (1990) used a standardized fertility ratio and a standardized very low birthweight ratio to weight populations for the needs for specific health-care resource requirements.

To summarize, age and gender provide the baseline of reliable and valid adjustments for need for health care. Marital status, fertility rates and ethnicity may also be useful indicators of need for particular services although more empirical evidence on
the relationships between these characteristics and the need for care is required to test the validity of these proxies and hence to validate their use as indicators of need for health care.

*Socio-economic characteristics or measures of deprivation*

The use of SMRs as an indicator of need has been criticized because it fails to recognize the impact of poverty, crowding and low socioeconomic status on health-care needs (see Fox 1978). As we showed in section 2, inequalities in health are related to socio-economic status (SES) with the lower income, more poorly educated, working class groups, experiencing significantly poorer health status than higher income, better educated, professional groups. This relationship holds across space and time despite different scales of analysis, types of measures of SES and health, life-cycle stage and causes of sickness and health. There are clear income gradients in life expectancy and occupational gradients for health status. There seems, however, to be insufficient evidence to warrant their inclusion in resource allocation formulae because:

* because strong correlations between deprivation and mortality are observed (see Forster 1979, Brennan and Lancashire 1978, Knox et al. 1980, Townsend et al. 1984, Carstairs 1981, 1982) weighting by deprivation risks 'double-counting' needs.

* very little is known of sub-regional and urban disparities in health (Wilkins 1986, Mays and Bevan 1987) to determine how deprivation could be used as a needs indicator at the small area level.

* little is known about how deprivation is related to adverse health outcomes or about the direction of causality between ill-health and deprivation.

* inclusion of a measure of deprivation implies that the health-care system should 'compensate' for the adverse outcomes of other social programmes. But dealing with these problems at source may be a more efficient use of resources
i.e., major determinants of health lie in the environment, housing and individual behaviour (McKeown 1979, Lalonde 1974).

* the validation of proposed deprivation indexes (e.g. Jarman, 1985) is compromised by the effect of availability on use. Jarman's work 'validates' measures of deprivation by GP perceptions of workload, which is unlikely to be a good indicator of population need for health care. Further, there is debate whether socioeconomic status rather than Jarman's index is a better proxy of need (Johnson and Milner 1988, Carstairs and Morris 1989b).

* the permanent sickness rate is a simpler indicator than deprivation (Scott-Samuel 1984) but because it correlates well with SMRs (Mersey Regional Health Authority 1983, Mays and Bevan 1987), its inclusion is unlikely to add significantly to understanding differences in health-care needs.

* examples of the addition of a deprivation index have been shown to be methodologically unsound (Carr-Hill 1989, Mays 1989).

In summary, there is considerable evidence of correlations between morbidity, and socio-economic conditions. But use of socioeconomic status to weight for 'between-population' health-care needs or deprivation is problematic, mainly because of the precise definition of deprivation, the close correlation of several proposed measures with mortality, the lack of any evidence on the validity and reliability of the measures as indicators of health-care needs and the administrative feasibility of some of the measures.

3.5 Combining and Weighting Indicators

So far we have considered the selection of appropriate indicators. In this section we address some issues of their use. Even if SMRs are acceptable and appropriate indicators of health-care needs, we are still left with several issues to resolve:
* the selection of the most suitable SMR for specific programmes

* the relationship between changes in SMRs and changes in health-care needs and the meaning of differences in the chosen indicators. Does an SMR of 110 represent a 10 per increase in needs over the provincial average? And does the difference between 100 and 110 mean the same as that between 120 and 130? In other words, is the relationship linear or does it take some other form?

* the selection of non-SMR indicators for specific programmes (e.g. marital status for mental health programmes).

* the combining and weighting of particular indicators. For example, Birch et al. (1990), arbitrarily combined fertility and birthweight ratios in a multiplicative fashion to derive a need indicator. But little is known on whether and how different indicators should be weighted.

Can we assume equal importance and hence weight on a 1:1 basis? Using national data in the UK, Brennan and Clare (1980) found the relationship between all-cause mortality and two measures of morbidity to be broadly linear at the small area population level. Where alternative weightings have been proposed the validity of the weighting has been shown to be suspect (Carr-Hill 1989).
3.6 Conclusion

Table 3.1 summarizes the relative strengths of the alternative types of data as proxies for health-care needs. The Standardized Mortality Ratio, as a measure of premature mortality, appears to provide the ‘best’ proxy for relative needs for acute care and chronic health-care services. In the case of other services such as mental-health and primary-health services, the case is less clear, indicating that research on the validity of alternative indicators of need for these services may enhance and improve the efficiency and equity of needs-based allocations.

Further research is also required to resolve questions surrounding the nature of the relationship between proxies of need and the need for health care, and to inform decisions concerning the weighting of indicators and valid methods of combining indicators in resource allocation formulae. At present there is not enough evidence to justify departing from the assumptions of a 1:1 relationship between SMR and health-care need, and simple, equal-weight approaches to combining indicators.

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<th>Basis of indicator</th>
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Key + indicator performs well on attribute
- indicator performs poorly on attribute
? assessment of indicator performance is subject to considerable uncertainty
SECTION 4
IMPLEMENTING NEEDS-BASED PLANNING

4.1 Introduction

In this section we deal with issues that are likely to arise resulting from implementation of needs-based planning. The issues identified can be categorized as:

* technical issues
* organizational issues
* institutional issues
* contextual issues

4.2 Technical Issues of Implementation

Needs-based planning has major data requirements which will impose administrative costs. As we have already stressed, the data requirements must be administratively feasible as well as reliable and valid. In particular, population-based planning requires data at the local level. However the precision of the indicators of need will be related to the size of the planning population. So, for example, two communities may have health-care needs indicators which differ significantly from the provincial average, but which have confidence intervals that overlap (i.e. are not significantly different from each other). Where needs-based planning is currently used, point estimates of needs indicators are used (i.e. no attention is paid to confidence intervals). Alternative approaches to dealing with the precision of needs indicators might be considered. This is particularly important where planning populations differ considerably in size because the precision of the estimate is likely to increase (i.e. the confidence interval will be narrower) with population size. As a result we might expect smaller populations to have extreme values of needs indicators with relatively low precision.

Secondly, needs-based planning requires the definition of planning populations. Existing patient rosters are inappropriate because such rosters are themselves
determined by service structure, availability and use. Instead, planning populations should be defined geographically in ways which coincide with the collection and availability of data on health-care needs or their proxies. But these geographical boundaries may not coincide with typical administrative boundaries, or with accessibility to services and historical patterns of service availability. Patients may use services outside 'their area' in times of emergency (e.g. occupational injury), on the advice of GPs with links to particular hospitals, according to between specialist referral, or as a matter of personal convenience (see Brazier 1987). These 'spillage' issues concern cross-boundary flows which need to be recognized in implementing a needs-based strategy as they have major funding applications.

The significance of cross-boundary flows can be substantial e.g. the use of Winnipeg as a referral centre for populations in N.W. Ontario (see Birch et al. 1990) and at the subregional level in the UK (see Brazier 1987). In terms of the calculation of population-based resource shares the central question is the determination of the costs of providing care to 'inflow patients' and how to manage the reimbursement of providers for those costs. In the UK, for example, the budget for providing services for the resident population is capped, but patients may seek care from, and providers may refer patients to, providers outside the local authority with these services being at the expense of the authority in which the patient is resident. This can create a perverse incentive to juggle with different types of care to attract non-resident patients without losing resident patients to other areas (see Brazier 1987). Furthermore, providers are 'rewarded' for deferring utilization by their own residents and attracting cases from other areas. If 'outsiders' are attracted, cross-boundary cost-adjustments may 'freeze in' existing differences in the levels of service provision. In addition attempts to allocate resources in line with needs may be compromised if resident individuals deemed to be without sufficient need to warrant service provision, seek and receive services in other jurisdictions (i.e. the resident authority is then 'charged' for services it deemed to be unnecessary or unwarranted). In the UK, the resource allocation procedures adjust for cross-boundary flows by weighting regional populations by the speciality-specific net flow of non-psychiatric inpatients (see Mays and Bevan 1987). These adjustments are technically problematic. In particular:
* the data used are two-years old,

* the calculations are based on notional populations rather than direct cash transfers,

* the adjustments are applied to future planned allocations rather than current allocations,

* the adjustments are utilization-based and essentially remove considerations of need and equity.

An alternative approach to the spillage problem is cross-charging in which areas contract directly with each other for the out-of-area treatment of residents. This allows for more direct costing and reimbursement and for areas to plan for the most cost-effective way of providing services for their population. But health-care providers face difficulties in controlling these flows (even if they believe the flows are inappropriate) in the system of health-care delivery based on patient choice and pluralism that exists in Canada.

The use of a global budget for financing a population's health-care needs does not imply that services funded on a fee-for-service basis cannot be utilized. But decisions concerning the use of these services would be taken in the context of a cost constraint (Birch et al. 1990). Such a system would require decisions to be made concerning

* services that should be provided locally
* services that are regional specialties
* services that are provincial specialisms and hence provided in only a few locations in the province.

For the higher tiers of specialisms, contracts and agreements (funded by cross-charging or directly by the MoH) may be used. But cross-boundary flows require managerial solutions as they have an impact on the ability to manage the utilization of a fixed amount of resources.
4.3 Organizational Issues of Implementation

If population needs-based planning is to address local needs then some degree of decentralization of the management of health-care is required. This and the next section deal with the local organizational requirements of needs-based planning and institutional effects of those requirements respectively. It should be remembered that funding issues are involved. While we regard needs-based planning as the primary concern of this report (i.e. the activity that establishes goals and a range of options for achieving those goals feasibly and effectively), the financing of needs-based planning must be addressed because although planning and funding are independent, they are also interrelated. But needs-based planning should occur, irrespective of the level of funding or basis of health-care financial strategy (e.g. cost containment, program transfers). In other words local planning and management are required to deal with the quality, effectiveness, efficiency and equity of health-care delivery in a decentralized setting, even if the financial capacity (i.e. share of total health-care funding) provided to a decentralized management body is not based on the populations' relative needs.

Several countries use special health authorities or tiers of local government to manage funds within broadly-based government-determined guidelines e.g. UK (see Maynard 1986, Mays and Bevan 1987) Finland (see Haro 1987) and the Netherlands (see Rutten and Freens 1986). For Ontario, the Spasoff Report (1987) recommended that District Health Councils (DHCs) be given the responsibility for area planning and administration. This recommendation was justified by:

* DHCs' broad mandate to undertake and coordinate health planning for their areas

* DHCs' considerable experience in bringing together a wide variety of 'experts' and community residents for health planning projects

* DHCs' understanding of the broad range of health, social, environmental and economic concerns of the community
* DHCs' broadly representative composition

* DHCs' lack of involvement in direct service provision

* DHCs' well-established community profile and respect.

But if the DHC becomes the vehicle for planning and administration, there still remains the questions of what services should be provided at this local level (see section 4.1) and what is the DHC's role in resource management. Whatever that role, their success (or that of any comparable agency) is likely to depend on:

* the mix of resources and skills available for administration and management
* adequate information base for assessing local needs and setting local priorities
* appropriate local accountability
* the speed and method of implementation of population-based planning

This final factor is primarily a question of adjustment from current to needs-based allocation that is likely to involve not only the local authority but the Ministry and other institutions and agencies. For example:

* In the UK, resource allocation policies were phased in over several years with no region having its level of funding cut below historical levels (see Bevan et al. 1980). Target resource allocations based on needs were calculated and expressed in relation to current allocations as 'distance from target'. Reallocation of resources between regions was then determined on the basis of partial movements towards targets. Reallocations in the following year were based on recalculations of needs-based allocations, and distance from these new targets, and hence moving targets.

* In New Zealand, a similar policy instigated in 1984 had a six-year phase-in period with tolerance zones for meeting targets and allowance for carrying over surpluses or deficits into the following years (see Barnett 1984). (The New Zealand plan was later withdrawn because no global budget was set, meaning
the resource allocation plan became a basis for demanding more resources rather than using resources more effectively).

* In Quebec, attempts are being made to bring the allocation of home-care expenditure into line with need, but these adjustments are applied only to the allocation of new (i.e. additional) funds. (see Secteur des services multicielenteles de primiere ligne 1989).

Based on the evidence of these applications of needs-based planning, a number of issues emerge. In particular:

- it may be argued that adjustments should be applied only to additional funding and that populations be protected from cuts in real levels of resources.

- because of the differences in existing stocks of capital and its valuation, it has proved difficult to adjust capital allocations to bring historic inequalities into line.

- some programmes or budgets may need to remain centralized and therefore require no adjustments for local planning e.g. certain educational, laboratory and administrative expenditures.

In summary, organizational issues require that attention be paid to the type of management structure, its skills and resources, information base and accountability for implementing needs-based planning. After an organization has been identified as appropriate, there remains the question of the nature and speed of adjustment.

4.4 Institutional Issues of Implementation

A major rationale for needs-based planning is that it is based on the needs of specific localized populations. It, follows therefore, that some local institution may be the most effective way of assessing local needs and managing resources to meet these needs. The local level, through municipal government, has traditionally played
an important role in shaping many of the factors that contribute to community health status - transportation, recreation, housing, day care, waste management and public health (see Sutherland and Fulton 1988). At present the DHC stands with the municipal public health departments as the existing, local, health-oriented institutions. District health councils were originally largely advisory bodies but have become partners in health planning. The ability of these institutions to plan and manage budgets must be seen in the light of existing resources, skills and accountability (see section 4.3). Indeed the options for implementing needs-based planning depend on what financial responsibilities the local institution will be given and the type of relationship desires with existing municipal and independent bodies. For example under the Medical Officer, public health departments currently organize public health nursing, nutrition, inspection, dentistry, child and adolescent services and drug and alcohol assessment services with less than 1.5 per cent of public health expenditures (see Poland and Eyles 1990).

The importance of a local body to manage health-care resources has potential major impacts on the Ministry of Health, other Ministries, hospitals, physicians, employers and the general population which must be addressed. In particular:

* Needs-based planning involves the decentralization of many management tasks currently performed at the central level. Models of decentralized management already exist in the form of the MoH public health branch model for policy formulation and implementation.

* the MoH's relationship with other Ministries may be affected as a need-based approach may blur jurisdictional boundaries between ministries (e.g. impacts of changes in resource allocation and management on the quantity, mix and distribution of demands for social care). Models of financial co-operation between ministries to deal with such issues already exist. In UK, the move from institutional to community care for those diagnosed as suffering from psychiatric problems has led to the creation of joint finance, a 'dowry system' in which funds go with the discharged patient from the institution to provide care in the community and from the UK Health Department to local social
service departments (Wistow and Hardy 1986, Eyles, 1988). Joint planning may be formalized between ministries for certain programmes.

* hospitals may be affected in that the distribution of hospital capacity may not be consistent with the distribution of needs for that capacity. The objectives of needs-based planning cannot be achieved if inequities in the distribution of capacities to provide care are allowed to compromise the implementation of a needs-based allocation of resource as happened in Australia (Eyles 1985) and Michigan, USA (Carpenter and Paul-Shaheen 1984).

* physicians may be affected in terms of their management and control of health-care resources. In particular

- needs for resources to provide care at the population-level would be largely independent of physician activity at the patient level.
- needs-based planning implies the use of population-based 'budgets' which caps the levels of activity that can be performed in a population under a fee for service system.
- 'Good care' may be more than good medical care and a needs-based approach may imply for complementing medical care with other types of support. If 'good care' is pre-empted by a medical definition, then resources are likely to flow to existing institutions 'freezing in' existing service delivery as happened with the attempt to rejuvenate the US hospital sector with Hill-Burton funds (see Rohrer 1987).

* employers, may be affected in their role as the providers of the health-care payroll tax. In the US, rising premiums led employers to lobby for capitated payment systems (see Himmelstein and Woolhandler 1988) and to reduce the number of hospital beds (see Bergthold 1984).

* populations may be affected in that a needs-based approach is likely to alter the current allocation of resources. For some, choices will decrease with respect to their existing range of options. Others will 'gain' as resources are gradually redistributed more in line with equity and efficiency principles.
In summary, several institutional issues arise for implementing needs-based planning. These are between and within Ministries, and between MoH and other important players, namely the providers of services and tax revenues. Implementation is also dependent on an appropriate arrangement being determined between the local level and the centre, represented by the Ministry with its functions of global budgeting, coordination and management.

4.5 Contextual Issues of Implementation

Several contextual issues require recognition as they set the framework for the implementation of needs-based planning. These contextual issues concern challenges to the health-care system's ability to provide equal and appropriate treatment for equal need. They are:

* the range of services or client groups covered by needs-based planning

* the appropriate geographical scale for needs assessment

* the role of private-sector resources

* appropriate methods of financing health care

* appropriate size of the health-care budget

First, with respect to the range of services covered, it is important that needs-based planning be seen as the mechanism for sharing all types of health-care resources. In some places, hospital and primary care sectors have been financed on separate bases\(^5\) e.g. Portugal (Giraldes 1990), the Netherlands (Rutten and Freens 1986), while in UK (Knox 1978) and Australia (Eyles 1985), a needs-based approach to allocating funds has been restricted to the hospital sector only, leading to transfers from planned (and budgeted) sectors to non-budgeted sectors, so that off-loading and cost-shifting may occur (see Paton 1985, Birch and Maynard 1987). For example in the UK, hospital-

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\(^5\) See Appendix 3 for a summary of needs-based planning in other countries.
based services are funded by needs-based allocations but primary care services are funded in response to demands (i.e. open-ended 'budget'). But access to hospital services is largely restricted to referrals from primary care physicians, the distribution of which has been shown to be unrelated to population needs (Birch and Maynard 1987). Needs-based planning must apply to all sectors if resource allocations are to reflect needs for care and are to promote equal access for equal need.

Secondly, there are questions about the appropriate geographical scale for needs assessment. While need may be adopted as the appropriate characteristic for determining population-based shares of health-care expenditures, this does not determine how those shares should be allocated within the population. It may also be necessary to develop and use sub-regional needs assessment to ensure fair shares within regions. Further, it may be necessary to develop and use mechanisms to divide up the regional share between health-care sectors.

Thirdly, the impact of the privately-funded sector may be important. Some societies (e.g. the Netherlands, New Zealand and Australia) have considerable privately funded hospital sectors which complicate their resource allocation strategies. In New Zealand, the private and public sectors were treated similarly to allow freedom of choice to patients, which resulted in higher than expected costs. In Australia, 'private' hospitals were treated as a care facility available to the resident population, and hence deducted from needs-based allocations, irrespective of the populations' ability to pay for those facilities. Areas with 'private' facilities were given less public resources because of this provision, potentially disadvantaging lower income groups in those areas (see Eyles 1985). A similar solution was advocated, although not implemented, for the UK. In the case of Ontario, to what extent should 'private' facilities for long term care be 'deducted' from population needs-based shares for these facilities, given that they are not accessible to all?

Fourthly, if needs-based planning is to be performed prospectively, then planned levels of the total budget for the future are required in order to determine a populations' prospective share.
Finally, needs for care are affected, *inter alia*, by changing demography, changes in medical practice and technology and the public's relative value of health and other goods. Although needs-based planning does not address the issue of absolute needs directly, the size of the overall health-care budget may affect the rate at which population-based allocations can be adjusted to meet needs-based targets.

### 4.6 Conclusion

Important policy issues have been identified which need to be addressed to enhance the probability of a needs-based approach being successful. We have looked at various managerial questions that arise. In particular:

- how could cross-boundary flows of patients be managed and what are the appropriate financial mechanisms to deal with them?

- how could we move to a system of needs-based planning?

- what are the likely impacts on the various groups in the populations?

- what factors might be used to determine the size of health-care expenditures under needs-based planning, which largely removes the influence of supply factors on total expenditure?
SECTION 5

RESEARCH NEEDS TO SUPPORT AND ENHANCE NEEDS-BASED PLANNING

5.1 Introduction

Needs-based planning is an alternative approach to health-care resource allocation. Compared to the existing systems of resource allocation used in Ontario, which are largely use-based, need-based planning appears to be more consistent with the stated goals of Canadian health-care policy. However, the success of needs-based planning is constrained by availability of data and knowledge of the relationships between population health status, health-care needs of populations and the cost-minimizing ways of meeting these needs. But that is not to say that needs-based planning should not be adopted until all these matters have been fully resolved. On the contrary:

a. A needs-based allocation of resources, even in its simplest form of equal-per-capita shares of provincial programme expenditure, provides a baseline allocation which offers major advantages over use-based methods. In particular it severs the link between service use and funding so that incentives for providers are determined by a) the size of the population being served and b) the number of other providers serving the population.

b. Some information, albeit limited, is available on the relationships between population health status, health-care needs and the cost of meeting needs. Also considerable population-based data are already available, in terms of vital statistics of populations and sociodemographic and socioeconomic data from the national census. Consequently, it is possible to adjust the baseline allocations for variations in population needs in ways which have already been validated (to a limited extent) and applied in other jurisdictions.
c. Additional sources and types of information pertinent to needs-based planning are already available (or soon will be) (see Appendix 4) which may provide data that can be used directly in the needs-based planning methodology (i.e. as proxies for need for health care) or could be used to help improve our understanding of the underlying relationships of interest (i.e. validate alternative proxies for need for health care).

In the rest of this section attention is focused on research questions that need to be answered in order to advance and improve the use of needs-based planning and hence move closer towards an allocation of health-care resources consistent with the efficient use of health-care resources.

5.2 Identification and Validation of Proxies for Population-Based Needs

This is concerned essentially with estimating the relationship between population health status (or its proxies) and the need for health care in the population. The ideal solution is to identify a variable measured at the population level, for which variation between populations corresponds closely with variation in population needs for health care. But because the best proxy for population need for care might differ between different services or care areas (e.g. mortality might be found to be a good proxy for the need for acute care but a poor proxy for need for primary care), validation of proxies for need should be performed separately for each care area (e.g. acute, primary, long term care, mental illness and health promotion and protection). The validation of proxies involves two elements:

a) identification of the variable or combination of variables which proximates most closely the need for health care (e.g. does a 'between-population' difference in SMR indicate a 'between population' difference in the need for acute health care?)

b) identification of the precise relationship (i.e. linear or other) between variation in the proxy variable and variation in the need for health care
(e.g. what does a 10 per cent difference in SMRs mean for health care needs, and is the implication for needs independent of the absolute level of SMR?)

Although some attention has been paid to the validity of proxies for need in the literature (see section 3) this is largely restricted to studies of the need for hospital-based care and is confined to UK populations. It is therefore important to replicate these studies using Canadian (and preferably Ontarian) populations and to extend the research to consider the validity of proxies for non-hospital based care.

A major issue in the validation of indicators of health-care need is the variable to be used as the standard (i.e. against which the indicators are to be validated). For example, the use of SMRs as an indicator of need has been criticized because of its poor correlation with health-care utilization (see Mays and Bevan 1987). But because health-care utilization is inappropriate as a measure of need these findings do not imply that SMRs are necessarily a poor proxy for health-care need.

In the absence of any available 'gold standard' measure of health-care need there are a number of guidelines that can be used in deciding on the standard for validation. In particular:

* it should be free of the influence of supply or availability of health care (and hence be population-based as opposed to patient-based).

* it should exhibit between-population variation at the level of resource allocation under consideration (e.g. between DHCs, counties etc).

* it should reflect contemporary population characteristics as opposed to historical ones.

* it should relate to aspects of morbidity amenable to specific types of health care, and associated with major health-care resource needs (e.g. conditions with high rates of incidence, and/or large health-care resource requirements).
In the UK literature, survey-based self-reports of the prevalence of chronic or permanent sickness have been used to validate SMRs as an indicator of health-care need. One could argue that the chosen standard should be used as the indicator of need, not just as a standard for validation of other indicators. Indeed there are a number of large Canadian population health surveys conducted in recent years which include similar self-reports of aspects of morbidity relating to health-care needs (see Appendix 4). However, as with the UK data on self-reported morbidity, the data are unsuitable as a indicator of health-care need in resource allocation for several reasons. In particular:

- the surveys are often 'once-off' presenting a snapshot of the population at one point in time, and hence do not produce the data of interest on a regular basis.

- where surveys are repeated the precise question asked may be changed between surveys, producing inconsistent data.

- the data are often collected at a population level which does not coincide or cannot be analyzed at the level of the planning populations.

As a consequence, the most productive use of these data may be as a standard for validating other indicators of health-care need which do not suffer from the same practical limitations. To what extent do administratively feasible proxies, such as SMRs, correlate closely to the indicators of health-care needs emerging from these surveys? But in using the survey-based data in this way, consideration must also be given to the size of the population sample at the unit of analysis. Because most of the Canadian data sources are based on surveys at the national level, the sample size at the level of the planning population considered for health-care resource allocation is insufficient to permit meaningful within province comparisons. Exceptions to this limitation are Sante Quebec and the Ontario Health Survey which were designed with the objective of allowing such within-province analyses to take place and hence may provide valuable data sources for the purposes of validating population-based indicators of health-care needs.
5.3 Indicators of Need for Additional Resources Per Unit Need for Care

Populations may differ in the resource requirements to provide services for a given level of need for care for several reasons (see Table 5.1). For example, a small community may require a larger number of beds in relation to population size because the level of inpatient flow is insufficient to recoup benefits from economies of scale of larger patient flows (e.g., higher bed occupancy rates). Similarly, in sparsely-populated communities, time and transport costs will be higher for a given level of community service. In both of these examples more physical resources are required to produce the same level of output (service provision). Cost differences will also occur where the physical resource inputs are the same but the money price of these inputs differs between populations. So, for example, large urban communities may have to pay higher wages to attract various levels or types of staff. Similarly remote rural communities may face higher money prices for gasoline which might be a major input in the cost of community-based care.

Table 5.1
Possible sources of differences in capacities to provide care by care setting

<table>
<thead>
<tr>
<th>Care setting</th>
<th>Institutional</th>
<th>Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Differing real resource input requirements (outputs fixed)</td>
<td>- economies of scale</td>
<td>- distance to clients</td>
</tr>
<tr>
<td></td>
<td>- bed occupancy rates</td>
<td></td>
</tr>
<tr>
<td>2. Differing money costs of fixed resource inputs</td>
<td>- employment costs of various labour inputs</td>
<td>- gasoline prices</td>
</tr>
</tbody>
</table>

Where cost adjustments have been made to needs-based allocations the basis of the adjustments has been either ad hoc (e.g. different target occupancy rates, population density) or based on the observed between-area variations in the costs of a given level of service (Pope et al. 1989). However this approach is essentially use-based. In particular:
* it fails to distinguish between additional costs which are exogenous (outside the control of the provider or manager) and those that are endogenous (within the control of the provider or manager). Consequently it may simply compensate for wasteful or inefficient resource utilization.

* it provides a level of additional funding based on the traditional or existing method of service provision (i.e. mix of resource inputs). In other words it assumes a fixed production function. But substitution between inputs in response to differing relative input costs, if technically feasible, would reduce the size of the cost adjustment required to equate capacities to produce services in accordance with needs (see Figure 5.1).

This suggests that research should be directed to exploring the source of 'cost-of-providing-service' variations between populations by comparing the inputs used with the outputs produced across different providers and institutions (see Birch and Maynard 1986) and the cost implications of alternative input mixes.

5.4 Monitoring and Evaluation of the Use of Resources

Needs-based planning is proposed here as a method of improving the efficiency and equity of the allocation of health-care resources (i.e. inputs) between populations. The way in which these resources are then used is a separate issue which requires the comparison of inputs used in a population with the outcomes (i.e. health improvements) produced in that population. In other words, the planning methodology does not, and cannot, also encompass performance appraisal in health-care provision (Birch 1988). The use of needs- based planning should be complemented by continuing to pay attention to methods for appraising health-care provider performance and the evaluation of the use of health-care resources.
Community $G$ faces the same unit price for capital but a greater price for labour than community $H$ (i.e. $G$'s budget line is $XY$, $H$'s budget line is $XX$).

$H$ produces $Q_o$ health care at $A$ (maximum output from available budget).

To produce $Q_o$ health care at point $A$ community $G$ requires additional budget resources equal to $YY'$ (shift out $G$'s budget line to pass through point $A$).

But to produce $Q_o$ efficiently, $G$ should substitute relatively less costly capital for more costly labour and produce at $B$. This requires only $YY'$ ($<YY''$) additional budget.
APPENDICES
Appendix 1

Required properties of an indicator of relative need for health care among populations

Validity

Validity is defined as the ability of an indicator to measure what it is intended to measure. There are several approaches to addressing the validity of an indicator.

Face validity: 'on the face of it' does the indicator measure what it should measure?

Content validity: does the indicator measure all the relevant aspects of what it should measure?

Both of these aspects of validity traditionally rely upon subjective assessments, and hence represent weak tests of validity (although more formal testable criteria have been developed and applied, see Kirshner and Guyatt 1985).

Criterion validity: how well does the indicator compare with a gold standard measure?

Because no gold standard measure exists in this case, criterion validity is not applicable.

Construct validity: how well does the indicator capture all the relevant aspects of the phenomena of interest?
In this case we examine the relationship between the indicator and another attribute or attributes of the underlying phenomena according to some theoretical relationship (Streiner et al. 1989). So, for example, if we are developing a measure of need for health care in a population, we might hypothesize that the measure is strongly related to measures of self-reported sickness and relatively poorly related to rates of hospital utilization. We might choose as our measure the age-adjusted mortality rate in the population. If a strong correlation is observed between mortality and self-reported sickness, and if it is in the expected direction, then this implies that both the measure and the construct were correct. (But if no relationship is observed we have no way of determining whether our measure, or our theory, or both, are incorrect). The measure of validity usually used is the correlation coefficient but what represents a significant correlation in this context remains subjective.

It might appear odd to attempt to validate one imperfect measure of (or proxy for) a non-measurable phenomena against another imperfect measure of the same phenomena. However it may be that an acceptable standard (albeit not a 'gold standard') exists but which, for various reasons, cannot be used in a needs-based planning exercise (e.g. the variable is recorded irregularly, or infrequently or for subsets of the population). Other indicators of needs for health care, which are usable in a needs-based planning exercise, could then be validated against the 'standard' indicator. This could be the case with, for example, data on self-reported sickness (which is not recorded frequently and universally) and data on mortality (which is recorded frequently and universally).

Reliability

Reliability is a measure of the extent to which an indicator is reproducible, or gives the same results, over different situations (Streiner et al. 1989). Variability in a measure may be due to either variability in the phenomenon being measured (e.g. population health status) and/or variability is the accuracy of measurement. Reliability is indicated by the reliability coefficient which expresses the proportion of
the variability in the measurement that is caused by 'true' variability in the underlying phenomenon being measured. This provides a measure of the extent to which we can differentiate among populations on the basis of their health status. In other words, if an indicator which had a low level of reliability then was observed to differ by, say, a factor of two across two populations we could not be confident that this indicated a difference in health status between these populations.

Responsiveness

Responsiveness is the extent to which an indicator value responds to changes in the underlying phenomena of interest. So, for example, a change in the prevalence of a chronic condition in a population may not be reflected in a measure of mortality in that population indicating that mortality is not responsive to the prevalence of that condition.
Appendix 2

Alternative Measures of Mortality Rates
(Adapted from Birch et al. 1990)

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:

   \[
   SMR = \frac{\sum_{i} m_i P_i}{\sum_{i} M_i P_i} \times 100 = \frac{\sum_{i} d_i}{\sum_{i} D_i} \times 100,
   \]

   where
   
   \(m_i\) = regional age-specific death rate for age group \(i\)
   
   \(M_i\) = provincial 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 provincial age
   specific death rates prevailed

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

   \[
   SMR = \left\{ \sum_{i} \frac{m_i}{M_i} \left( \frac{M_i P_i}{\sum M_i P_i} \right) \right\} \times 100,
   \]
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:

   \[
   RMI = \sum_i \frac{m_i}{P_i} \cdot \frac{1}{P'}
   \]

   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" introduced 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:

\[
YMI = A \times \left( \sum_i \frac{m_i}{M_i} L_i \right),
\]

where

\[
L_i = \text{the length of each age group in number of years}
\]

\[
A = \frac{1}{\sum_i L_i}
\]

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. The SMR 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.
Appendix 3

Needs-based resource allocation in other countries

United Kingdom

Target shares of hospital-based resources are calculated for the fourteen regional health authorities (RHAs) in England based on the mean age and gender-specific rates of utilization in England applied to regional populations and weighted by regional specific SMRs. Actual allocations between regions are then based on partial reductions in each region's difference between its current and target share.

Each region is left to determine how to allocate resources within its population. In practice some have adopted the regional formula for sub-regional allocation.

Primary care services are funded through a mixture of capitation, quasiprimary care and fee for service payments. The capitation payment is based on average levels of utilization by elderly and non-elderly populations without any weighting for needs.

Similar methods of funding the respective sectors are used in Northern Ireland, Wales and Scotland. The recent reforms to the National Health Service are likely to have considerable impact on these resource allocation mechanisms with more emphasis being given to capitation payments (but not needs indicators) in primary care funding, and to equal per capita funding for hospital services.

Portugal

Currently health care is funded on an incremental basis (i.e. last years allocation plus some growth) with no explicit regional allocation. However, an approach similar to that for hospital services in the UK is being implemented for current (not capital) expenditure which will calculate age and sex-adjusted shares of national utilization rates weighted by SMRs. Regional shares will be adjusted for health-care service coverage, so that if a region has relatively adequate service coverage by national average standards, then it receives less additional funding even
if the indicator of need is high. The formula is also employed somewhat differently for preventive and curative services, transfers to the private sector, and local inpatient hospital care. (See Giraldes 1988, 1990).

Netherlands

Plans to distribute health care funds to regions on the basis of need have yet to be operationalized (in particular the indicator for need has not yet been agreed upon). There is regional responsibility for hospital care but municipal responsibility for public health and primary care, all within broad national guidelines. One problem encountered in Netherlands in calculating regional budgets is regional health services are financed from a variety of sources, with at least 25 percent being privately financed. This is further complicated by an administrative structure which has separated planning and financing activities (see Rutten and Freens 1986).

Australia

Traditionally a two-tiered system of health care provision prevailed with substantial contributions of private funds in financing health care (fees and insurance) at both primary and tertiary care levels. A RAPW-type formula for allocating hospital resources has been adopted by New South Wales which uses notional regional (age and sex-adjusted) utilization weighted for SMR and corrected for cross-boundary flows and variations in 'exogenous' costs (see Eyles 1985).

Primary health care operates under fee-for-service reimbursement covered largely by health insurance and hence resource allocation which is not needs-based.

New Zealand

Since 1980, regional hospital resource allocations have been determined by a population-based formula similar to that in the UK, with notional (age and gender adjusted) regional bed utilization adjusted for SMR (or standardized fertility ratio for obstetric care), cross-boundary flows, and differential exogenous costs. Public health and some community care is publicly financed and administered at the local level.
Primary care is fee-for-service and generally billed directly to patients or their insurance companies (see Barnett 1984).

Finland

Funding allocations between 461 communes (average population 11,000) (except for specialist services housed in 21 central hospital regions) are calculated on the basis of income levels of the communes (subsidies between 35 and 70 percent), subject to national standards. The balance of funds are raised through local taxes (approx. 31%), national sickness insurance (approx. 15%) and private out-of-pocket expenses (roughly 14%) (see Haro 1987).

Norway

The allocation of revenue for hospital services to regions and municipalities is based on formulae that use all-cause SMR as a measure of need (in addition to the usual age and sex distribution), but in which mortality is weighted much less than in the UK and New Zealand models (see Crane 1985).
### Appendix 4: SOURCES OF POPULATION-BASED HEALTH INDICATORS

<table>
<thead>
<tr>
<th>Survey</th>
<th>Year</th>
<th>Approximate sample size</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NATIONAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadian Sickness Survey</td>
<td>1950-51</td>
<td>10,000</td>
<td>Dominion Bureau of Statistics &amp; National Health and Welfare 1960</td>
</tr>
<tr>
<td>Canada Health Survey</td>
<td>1978-79</td>
<td>31,000</td>
<td>Health and Welfare Canada/Statistics Canada 1981</td>
</tr>
<tr>
<td>Canada Fitness Survey</td>
<td>1981</td>
<td>22,000</td>
<td>Canada Fitness Survey 1983</td>
</tr>
<tr>
<td>Canadian Health and Disability Survey (supplement to Canadian Labour Force survey)</td>
<td>1983-84</td>
<td>126,700</td>
<td>Statistics Canada and Secretary of State of Canada 1986</td>
</tr>
<tr>
<td>Health Promotion Survey</td>
<td>1985</td>
<td>11,200</td>
<td>Health and Welfare Canada 1988</td>
</tr>
<tr>
<td>General Social Survey</td>
<td>1985</td>
<td>11,200</td>
<td>Statistics Canada 1987</td>
</tr>
<tr>
<td>Smoking Supplement to the Canadian Labour Force Survey</td>
<td>1983, 86</td>
<td>16,000</td>
<td></td>
</tr>
<tr>
<td>Health and Activity Limitations Survey</td>
<td>1986-87</td>
<td>220,000</td>
<td>Statistics Canada 1988</td>
</tr>
<tr>
<td><strong>ONTARIO PROVINCIAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ontario Health Survey</td>
<td>1990</td>
<td>55,000</td>
<td></td>
</tr>
<tr>
<td><strong>ONTARIO LOCAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toronto Health Survey</td>
<td>1983</td>
<td>1,000</td>
<td>City of Toronto 1984, 1990</td>
</tr>
<tr>
<td>Ottawa-Carleton Regional Health Unit Community Health Survey</td>
<td>1985</td>
<td>900</td>
<td>Corber 1986</td>
</tr>
<tr>
<td>North Hamilton Community Health Survey</td>
<td>1986</td>
<td>650</td>
<td>Feightner and Rice 1989</td>
</tr>
</tbody>
</table>
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