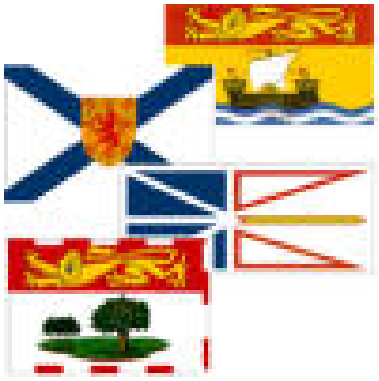
Atlantic Supply and Demand Roll-Up

Atlantic Health Education/Training Planning Study



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EXECUTIVE SUMMARY

Med Emerg International (MEI) was retained by the Atlantic Health Human Resources Association (AHHRA) to conduct a regional education/training program planning study for the four Atlantic Provinces (Nova Scotia, Newfoundland & Labrador, Prince Edward Island and New Brunswick). The objective of this study is to forecast the Atlantic region's future supply of and demand for major health care occupations and, most importantly, to assess the implications for the corresponding education/training programs. This is to be accomplished by building on needs assessments conducted by each Atlantic province in Phase I of what is a two-phase regional cooperation initiative on health human resources. The present study is Phase II, and its overall goal is *"to provide appropriate education programs in terms of suitability and quantity of health human resources through enhanced education planning"* (RFP AHHRA-001, 2003).

As the first step of the project, MEI carried out a comparative analysis of the Phase I studies from each of the provinces. The present report addresses the second step in the Phase II study: The Atlantic supply and demand roll-up. The objectives of this component of the study were:

1. In cases where definitive forecasts are available from four provinces, combine available observations and make best effort recommendations regarding supply issues;
2. Identify demand side data gaps;
3. Recommend minimum and sufficient data sets (occupations and data fields) for planning purposes;
4. Make recommendations for an ongoing process to harmonize data collection and analysis; and
5. Provide a report on the status of data aggregation and include key milestones in the completion of the data aggregation process.

Roll-up of Forecasts from the Four Provinces:

Out of 30 professions, seven were forecasted for five years by each province as part of their Phase I studies: licensed practical nurses, medical laboratory technologists, medical radiation technologists, occupational therapists, physiotherapists, registered nurses, and social workers. The Atlantic Regional roll-up of Phase 1 data conducted in our analysis suggests there will be an overall shortage of all of the seven professions forecasted. However, it is important to note that in some of the professions, certain provincial forecasts indicate a surplus is possible. It must also be noted that the roll-up for the Atlantic Region may not provide meaningful numbers for regional HHR planning as a result of differences in, and limitations of the methodologies used.

Planning Variables and Data Sources:

Through teleconferences and face-to-face meetings, an inventory was conducted of data sources available in the Atlantic Provinces to support the simulation modeling that will be conducted as part of this study. This investigation was based on the Health Human Resource Planning (HHRP) Conceptual Framework developed by O'Brien Pallas, Tomblin Murphy, and Birch (2001). The inventory identified many sources of data and information that were useful for this study, but also identified significant gaps.

The identification of final variables to be included in the simulation, their measurement, and the roll-up of data to construct them is an ongoing process.

Data sources and recommendations regarding data harmonization issues, minimum data sets and data roll-up are addressed in this report for the following categories of variables:

Population Health Needs and Service Requirements:

The team will use a needs-based approach. The key steps in this stage are the measurement of population health needs and the translation of these needs into health service requirements. The key difference between this approach and the approaches used in previous health human resource planning reports is that the analysis is based on the use-need relationship as opposed to the use per capita relationship. In this way the level and distribution of needs in the population is the core element of the analysis. The team will roll-up data on population health status and changes in that status over time from survey data and vital statistics, and utilisation data by profession and sector for purposes of estimating current and future service requirements.

Supply of Health care Providers:

Registration data from associations and public payroll data were the two primary sources of data identified for describing the number and attributes of providers across professions. The project will use multiple years of data from these two sources as the primary source of supply data. Based on our assessment of registration and payroll data across the Atlantic Provinces, recommendations are made regarding data harmonization, and how to best utilize these two data sources for future HHR planning.

Education/Training and Production of Health Human Resources:

Key variables to be rolled up as part of the study include attributes of training programs (e.g. number of seats, years required to complete the program, cost of tuition and fees, and throughput), and the attributes of graduates (e.g. age, sex, debt load, and percent entering the current stock of providers in the Atlantic Provinces). The Phase I reports will be the source of much of these data.

Financial Variables:

Key variables of interest that can be assembled from available data include public expenditures on each provider group, and salaries and average earnings by provider.

Management, Organization and Delivery of Services:

The information requirements identified under this category will be addressed later in the project through the environmental scan.

Resource Deployment and Utilisation:

A variety of data sources were identified that describe utilisation by health sector and by provider group. Key variables that we need include:

- The volume of services provided in each sector (e.g. acute care hospitals, long-term care institutions, and community care settings) by population age and sex,
- Utilisation of provider groups by population age and sex,
- The distribution of healthcare provider groups by sector, and
- Measures of productivity of each provider group.

Current patterns of utilisation will, in combination with estimates of population health need, be used to estimate future service requirements. Utilisation data are also critical for considering the level of productivity of providers and hence the link between service requirements and health human resource requirements.

Patient Outcomes:

In this study, we are incorporating data on population health needs, including risks to health (e.g., smoking, obesity, diet etc), self-assessments of health (excellent, very good, good, fair, poor), mortality and morbidity. Such data are available from surveys and vital statistics. We will not be explicitly considering outcomes of care attributable to the services provided by specific professions.

Provider Outcomes:

Consolidated payroll data in the provinces provides one source of data we are considering as a means to assess provider outcomes. These data include information on worked versus earned hours, sick leave and disability. We will examine studies already completed in the provinces on workers compensation, disability and sick leave.

System Outcomes:

A variety of data sources were identified that capture system outcomes, especially financial outcomes. These include data such as rates of hospitalization and the amount of money spent on the various health sectors, the number of people treated in each health sector, case intensity, discharge efficiency, proportion of acute versus non-acute care, outpatient/inpatient surgery rates, and occupancy rates.

System outcomes will be studied as part of the simulation modeling. Simulation modeling will provide important information on potential system outcomes of changing population needs, as well as the system implications of changes in the health education/training program planning process.

We anticipate completion of data acquisition by October 31, 2004, and completion of simulation model development by November 15, 2004.

CHAPTER 1 - INTRODUCTION

Med-Emerg International (MEI) was retained by the Atlantic Health Human Resources Association (AHHRA) to conduct a regional education/training program planning study for the four Atlantic Provinces (Nova Scotia, Newfoundland & Labrador, Prince Edward Island and New Brunswick). MEI brings to the project a combination of practical experience and theoretical expertise. The practical experience is that of MEI as a large employer of health care providers who are directly involved in the delivery of primary health care services. The theoretical expertise is that of a leading and highly respected academic-based research team with unmatched accomplishments in health human resource (HHR) planning and modeling. Members of this research team include Dr. Stephen Birch of McMaster University, Dr. Linda O'Brien-Pallas of the University of Toronto, Professor Gail Tomblin Murphy of Dalhousie University and Dr. George Kephart, also of Dalhousie University.

The objective of this study is to forecast the Atlantic region's future supply of and demand for major health care occupations and, most importantly, to assess the implications for the corresponding education/training programs. This is to be accomplished by building on needs assessments conducted by each Atlantic province in Phase I of what is a two-phase regional cooperation initiative on health human resources. The present study is Phase II, and its overall goal is *"to provide appropriate education programs in terms of suitability and quantity of health human resources through enhanced education planning"* (RFP AHHRA-001, 2003).

Phase I reports were prepared by each of the four provinces. These reports present a descriptive view of the current health human resources (HHR) status in each of the provinces, as well as forecasts for those health occupations for which sufficient data were available. The reports reflect the provincial initiatives to produce a current and future profile of the supply of and demand for major health occupations. As a result, the current study does not require primary data collection by the consulting team, but will build on primary data collection conducted in the Phase I studies. Thus, the data collected in Phase I serve as the essential foundation for the present Phase II study.

The Phase II study consists of seven steps that address the overall goal as stated above. They include the following:

- Comparative analysis of the Phase I studies,
- Conduct roll-up of Atlantic provinces' supply and demand data,
- Create an inventory of education/training programs,
- Create and inventory of continuing education/training programs,
- Carry out an environmental scan of education/training issues,
- Develop a scenario based education/training program forecasting tool, and
- Conduct final analysis and provide recommendations.

As the first step of the project, MEI carried out a comparative analysis of the Phase I studies from each of the provinces[1]. This comparative analysis provided our consulting team with an understanding of the Phase I work, including the inherent assumptions and limitations of the data and the implications for the next steps to be carried out in this Phase II study.

Several themes emerged from the comparative analysis of the Phase I studies. One major theme was around data management and data standardization. The need to collect and maintain data on each of the occupations was evident across the four provinces in order to appropriately plan for health human resources. The data collected in the Phase I reports were largely supply based, were not consistently collected across the four jurisdictions, and covered different time frames. The extent to which the supply of and demand for occupations was analyzed and future levels of supply and demand were forecasted varied among the four Phase I provincial reports. It should also be noted that Nova Scotia has released its forecasting report since the submission of our comparative analysis.

In our initial proposal and in the comparative analysis, we emphasized that training needs cannot be examined in isolation from other health care policies. Where the number of providers was estimated to be insufficient to meet the future needs for services, policy-makers have traditionally viewed this as the need to increase the capacity of training programmes to fill the anticipated 'gap'. Although this would eventually lead to an increase in the stock of providers, and hence the flow of services, such policies are often inappropriate where human resource imbalances are immediate or are of a temporary (or cyclical) nature. In such cases, the policy challenge is more one of 'fine tuning' demands and supply. In contrast, increasing training capacity generates more medium to long-term returns of an on-going nature, more suited to structural problems in health human resource supply.

There are several alternative (or complementary) approaches to dealing with forecasted future shortfalls. These include: increasing the participation rate of existing health human resources; reducing the rate of retirement from the professions and the rate of loss to other jurisdictions/professions; increasing the employment and worked hours of existing health human resources; increasing the productivity of existing health human resources; and making use of opportunities for substitution between different types of health human resources, as well as between non-human and human resources (O'Brien-Pallas, Birch, Baumann, and Tomblin Murphy, 2001; O'Brien-Pallas, Birch, and Tomblin Murphy, 2001; O'Brien-Pallas, Alksnis, Wang, Birch, Tomblin Murphy, et al., 2003).

Accordingly, we proposed and are developing a simulation model for the supply of training/education places that is based on explicit recognition of the changing nature of health care provision and the impact of health care human resource policy on the needs for training capacity. Not all of the HHR planning variables that we identified in the comparative analysis report can be included in the simulation model. Within the confines of available data, and the limits to complexity that can be incorporated into simulation, consideration will be given to the expected future need for services, the ability of the expected future stock of providers to meet that need, and the implications for the size and nature of training programmes. A system dynamics simulation approach is being developed for this purpose.

[1] O'Brien-Pallas, L, Tomblin Murphy, G, Birch, S et al. Atlantic Health Education/Training Planning Study: Comparative Analysis of Phase I Studies. Med-Emerg International Inc. Mississauga, Ontario. Canada. April 30, 2004.

This report addresses the second step in the Phase II Study: conducting a roll-up of Atlantic Provinces' supply and demand data. A critical step in developing the simulation tool is identifying relevant data and rolling it up in a standardized format. This includes data not just on training programs, but on other components of HHR planning as well (e.g. supply, demand and deployment) (O'Brien-Pallas et al., 2001). Combining data from different sources often presents organizational, as well as technical challenges, due to different rules and policies governing data access and confidentiality. Resolving data compatibility issues requires careful planning, attention to detail, and working closely with technical staff in each province.

In consultation with the Steering Committee, we have identified the following objectives for this report:

1. In cases where definitive forecasts are available from four provinces, the contractor will combine available observations and make best effort recommendations regarding supply issues;
2. Identify demand side data gaps;
3. Recommend minimum and sufficient data sets (occupations and data fields) for planning purposes;
4. Make recommendations for an ongoing process to harmonize data collection and analysis; and
5. Provide a report on the status of data aggregation and include key milestones in the completion of the data aggregation process.

These objectives are addressed in the following chapters. In Chapter 2, we combine available observations from the Phase I reports and the recently released forecasting report from Nova Scotia, and make best efforts recommendations regarding supply issues. In Chapter 3, we address objectives 2, 3 and 4. We begin Chapter 3 by presenting an inventory of the data sources we have identified in each province that address the information requirements we presented in the comparative analysis report. Data gaps on both the supply and demand side of the planning process are identified. We discuss how the data sources that are available can be combined to develop critical variables that will be required for HHR and training program planning. We also make recommendations regarding variables that we plan to incorporate into our modeling, and the data that will be required from the provinces to support these developments. Finally, in Chapter 4, we report on the status of the data aggregation and identify the key milestones in the completion of this process.

The identification of final variables to be included in the simulation, their measurement, and the roll-up of data to compute them is an ongoing process. Thus, this report documents the current status of our work on data collection and variable measurement, and will provide a valuable opportunity for reflection and feedback from the Steering Committee and the provinces.

CHAPTER 2 - ROLLUP OF PHASE 1 SUPPLY-DEMAND ANALYSIS

The forecasting methodology underlying each of the provincial Phase I studies were developed independently, thus making it potentially difficult to provide a meaningful cumulative forecast for the Atlantic Region. The forecasting methodologies must, therefore, be examined in order to indicate limitations and provide a basis for assumptions made for the regional roll-up. This chapter will first briefly describe the forecasting methodology used in each of the provincial studies. The roll-up for professions that were forecasted in all four provinces will then be presented, followed by commentary with respect to limitations of this regional roll-up of Phase 1 projections.

Overview of Methods and Professions Covered

Newfoundland & Labrador

The Phase I report for Newfoundland & Labrador (Newfoundland & Labrador Health and Community Services Human Resources Planning Steering Committee, 2003) included the identification and application of a model for integrated health human resource (HHR) planning, the preparation of five-year forecasts (to 2007) of supply of and demand for HHR, and recommendations concerning the gaps between forecasted supply and demand. The authors of the report estimated future supply for 13 health professions (Table 1) by comparing the estimated future additions to an occupational group (i.e., new entrants, re-entrants and net inflow to the province) with estimated future losses (based on estimated retirements and a constant percentage of 'losses' for reasons other than retirement). The difference between estimated losses and estimated entrants, on top of the current number of providers, provided the estimated future supply. Tables 2 and 3, respectively, summarize the key supply and demand variables included in their forecasting analyses.

Nova Scotia

Nova Scotia's Phase I report (Health Care Human Resource Sector Council, 2003a; Health Care Human Resource Sector Council, 2003b) provided 14 forecasts for 17 health occupations; continuing care assistants, personal care workers and home support workers were grouped together (Table 1). The forecasts projected the surplus or shortage of health professionals in 2008. Supply was forecasted by the current number of providers adjusted for net changes in supply related to 'losses' (retirements, deaths and 'emigrants') and 'gains' (new entrants and 'immigrants'), and allowing for differences in activity rates.

A common conceptual framework was used to forecast the requirement for each occupation although the precise methods for forecasting were occupation-specific in order to account for the differing nature of service delivery and data availability. Where possible the requirements for human resources were considered in the context of service planning. Accordingly, the level of services were forecasted based on current age- and sex-specific levels of utilisation adjusted for severity, expected changes in the demographic mix of the population, and planned service developments (expansions and contractions).

The number of providers required to produce this level of services, based on current levels of productivity, together with known vacancies was used as the 'demand' for providers. For those professions where utilisation data were not available, the methodology reverted to planning to maintain existing population-provider ratios.

The conceptual basis of the Nova Scotia forecasts, and in particular its link to service planning, is helpful and leads to the adoption of informative planning methods. However, the approach remains constrained to using existing rates of service utilisation and delivery as an appropriate basis for health care services in the future. No consideration is given to the role of changes in epidemiology (e.g., improvements in health within age groups) and productivity (e.g., increases in services per provider) over time. Since the former would reduce the total service requirements in the population and the latter would increase the supply of services from the stock of providers, this means the forecasts are likely to overestimate the requirements for HHR in order to serve health care needs to current standards.

Prince Edward Island

The Prince Edward Island (PEI) Phase 1 report (Prince Edward Island Advisory Committee on Health Human Resources, 2001) is focused on producing five-year estimates (to 2006) of supply of and demand for health human resources and analyzing gaps between estimates of future supply and demand. A total of 10 health professions were forecasted in the report (Table 1). An analytical framework made up of supply-side and demand-side models was used. The forecast model specifically looked at the available supply of HHR, the required demand for HHR for the health care delivery system, and a gap analysis, i.e., the interaction of supply and demand. The current workforce was used as the baseline for the supply-side estimates. Additions to the workforce (new entrants, re-entrants and net inflow) and losses from the workforce (deaths, retirements and losses for other reasons) were 'modeled' to estimate the future supply (Table 2). The demand-side model also used the current workforce as the baseline, and applied the current provider: population ratio to the projected future population. Final estimates of future demand were then made through additional demand factors (vacancies, postings and planned new positions) less any planned reductions in positions (Tables 2 and 3).

No attempt is made to justify any planned changes in positions that are utilized in the demand-side model. In this way, the focus of the demand-side model is managerial as opposed to population or needs based. Underlying the demand-side model is an assumption that "the existing provider to population ratio is . . . the desired ratio going forward" (Prince Edward Island Advisory Committee on Health Human Resources, 2001, p.46). Any discrepancy between the managerial notion of demand and these existing ratios appears to be accommodated in the model through 'qualitative factors' that may affect demand. However, these are assumed to have a maximum impact on demand of ten per cent. These assumptions have no objective justification and represented at best 'ad hoc' planning parameters.

Table 1: Occupations Reported in Phase I Studies

OCCUPATION	NB	NL	NS	PEI	OCCUPATION	NB	NL	NS	PEI
Addiction Worker/Counsellor	✓			✓	Medical Laboratory Technologists	✓⌘	✓⌘	✓⌘	✓⌘
Anaesthetic Technician				✓	Medical Physicist				✓
Audiologist	✓⌘	✓⌘	✓	✓	Medical Radiation Technologists	✓⌘	✓⌘	✓⌘	✓⌘
Biomedical Technician				✓	Nurse Practitioners	✓			
Cardiopulmonary Technician				✓	Occupational Therapists	✓⌘	✓⌘	✓⌘	✓⌘
Child Care Worker				✓	Occupational Therapy Workers				✓
Child Development Worker				✓	Operating Room Technician				✓
Child Life Workers				✓	Optician			✓	
Chiropractor			✓		Optometrist	✓⌘		✓	
Clinical Nurse Specialist	✓				Orthodic Technician				✓
Combined Lab/X-ray Technologist				✓	Orthopaedic Technician				✓
Community Residential Worker			✓	✓	Orthotist				✓
Continuing Care Workers			✓⌘[2]		Paramedics/EMTs	✓⌘		✓	✓⌘
Cytology Assistant				✓	Personal Care Workers			✓⌘[1]	
Dental Assistant	✓		✓	✓	Pharmacists	✓⌘	✓	✓⌘	✓
Dental Equipment Technician			✓	✓	Pharmacy Technician	✓⌘			✓
Dental Hygienists	✓		✓	✓	Physicians	✓⌘		✓	
Dentists	✓		✓	✓	Physiotherapists	✓⌘	✓⌘	✓⌘	✓⌘
Denturist			✓		Physiotherapy Aide				✓
Diagnostic Sonographer	✓⌘		✓⌘	✓	Prosthetist	✓			✓
Dieticians and Nutritionists	✓	✓⌘	✓⌘	✓	Psychologists	✓	✓⌘	✓⌘	✓
Dosimetrist					Psychometrician	✓			✓
ECG Technician	✓⌘			✓	Public Health Officers	✓⌘			
EEG Technician	✓			✓	Radiation Therapists	✓⌘	✓⌘	✓⌘	✓
Environmental Health Officers				✓	Registered Nurses	✓⌘	✓⌘	✓⌘	✓⌘
Group Home Workers				✓	Rehab Assistant	✓			
Health Managers		✓	✓		Resident Care Workers				✓⌘
Health Records Administrators/Technicians	✓⌘		✓	✓	Respiratory Therapists	✓⌘	✓⌘	✓⌘	✓
Histology Assistant				✓	Social Services Workers				✓
Home Support Worker/Home Care Worker			✓⌘[1]	✓	Social Workers	✓⌘	✓⌘	✓⌘	✓⌘
Homemakers				✓	Speech Language Pathologists	✓⌘	✓⌘	✓	✓⌘
Licensed Practical Nurses	✓⌘	✓⌘	✓⌘	✓⌘	Therapeutic Recreation			✓	
Massage Therapist			✓		Venipuncture Technician				✓
Medical Equipment Technician	✓⌘				X-Ray Attendant				✓
Medical Laboratory Specialists	✓			✓	Youth Workers				✓

[2] Continuing Care Workers, Home Support Workers and Personal Care Workers are grouped as one forecast.

✓ - Profiled ⌘ - Forecasted

Table 2: Summary of Supply Factors in Provincial Forecasting Models.

SUPPLY	Newfoundland & Labrador	Nova Scotia	Prince Edward Island	New Brunswick - Other Health Occupations	New Brunswick - Physician Report
Entry into Workforce					
Baseline	Current workforce (number of employees including managers)	Current workforce = head count - not actively working	Current stock of HHR - those that are currently working	Current stock of HHR - those that are currently working	Base stock of physicians, by speciality
New Entrants	New entrants - total graduate supply + total other supply	New entrants = new graduates from ns and other provinces	New entrants – based on currently prevailing conditions	new entrants – new graduates within province and out of province	New entrants from Medical Schools + International Graduates
Migration		Net migration - derived from NS statistical review - migration by age and sex - not available for health occupations	net migration – immigration – emigration (not on an occupational basis – general migration rates by age group and sex)	net migration – immigration – emigration (not on an occupational basis – general migration rates by age group and sex)	Interprovincial migration and immigration
Other supply		Re-registrants	Reserve pool – workers that are trained in an occupation that have not chosen to work in that occupation	Reserve pool – workers that are trained in an occupation that have not chosen to work in that occupation	
Exit from workforce					
Migration		Out migration	Exits from work force (non-retirement, non-death) – due to lifestyle choices, continuing education, and health issues. PEI – exit rate – used nursing exit rate as a proxy	Exits from work force (non-retirement, non-death) – due to lifestyle choices, continuing education, and health issues. Proxy 2.5% for nursing, nursing related and social sciences; 2% for rehab services and pharmacy; 1% for all others	Interprovincial migration and emigration
Deaths		Deaths	Deaths – age/sex specific, not occupation	Deaths – age/sex specific, not occupation	Deaths
Retirements	Projected retirements	Projected retirements	Retirements – captured through the model's age-cohort approach, conservative	Retirements – captured through the model's age-cohort approach, conservative	Retirements
Other factors			Other qualitative supply factors – i.e. Incentives (expanded scope of practice) and disincentives (non-competitive wages) Model allows for these factors to be weighted, based on perceived impact on a 0-10% scale – determined through focus groups	Other qualitative supply factors – i.e. Incentives (expanded scope of practice) and disincentives (non-competitive wages) Model allows for these factors to be weighted, based on perceived impact on a 0-10% scale – determined through focus groups	Weighted supply factors

Table 3: Summary of Demand Factors in Provincial Forecasting Models.

DEMAND	Newfoundland & Labrador	Nova Scotia	Prince Edward Island	New Brunswick - Other Health Occupations	New Brunswick - Physician Report
Baseline Demand	Current demand = total supply required over forecasting period	Demand is independent of supply	Current demand = current supply from supply model	Current demand = current supply from supply model	Based on current utilisation of physician services
Vacancies (job postings)	Vacant positions in the system	Vacant positions in the system	Vacant positions in the system	Vacant positions in the system	
Planned Changes In The Number Of Positions		Changes in service delivery	Planned positions – reduction in positions	Planned positions – reduction in positions	Service Delivery changes
Other Factors		Demographics	Other qualitative demand factors (add or subtract) - these are based on the magnitude of the impact; magnitude determined by focus groups (i.e. Demographics, utilisation, trends)	Other qualitative demand factors (add or subtract) - these are based on the magnitude of the impact; magnitude determined by focus groups (i.e. Demographics, utilisation, trends)	Population changes

New Brunswick

The New Brunswick (NB) report (New Brunswick Department of Health and Wellness, 2002) provided a five-year forecast (to 2007) of 21 health professions, and provided a ten-year forecast for physicians (New Brunswick Department of Health and Wellness, 2003) (Table 1). As in PEI, this provincial study also estimated the requirements to satisfy management's plans for the health care workforce. Closely related to the PEI Phase I study[3], the report for NB had similar terms of reference and the use of the same analytical framework and implicit assumptions (see above). For the health occupations, excluding physicians, our analysis of the PEI report applies to this NB report as well. Tables 2 and 3 summarize the key supply and demand variables included in the forecasting analysis.

However, in the case of the NB Physician Workforce Report, there was some variation in the approach used. In particular, physician billings data were used in estimating both the supply of physicians and the demand for physicians. On the supply side, the future number of registered physicians was estimated by applying estimated future gains and losses to the current stock of physicians. This estimated number of physicians was then adjusted for different levels of physician activity, as measured by current between-physician variations in billings, to create a quasi FTE future physician supply. It was assumed that whatever 'explains' the current levels and variation in billings (i.e., the service output from the current physician stock) is 'fixed'.

The demand for physicians was estimated by applying current population-based age- and sex-specific billings to estimated future populations. Accordingly, instead of assuming that the physician-to-population ratio should remain constant, it assumed that the average age- and sex-specific level of billings should remain constant, e.g., the average level of billings for 65-75 year old females in five years time will be the same as it is today. Hence, this approach to estimating demand is simply a weighted sum of changes in the size of age and sex subgroups of the population where the weights are current per capita billings in these age and sex groups. This provides a demographically-adjusted measure of current demand against which the estimated number of 'FTE physicians' was compared.

Phase I Roll-Up

The current study requires the consulting team to address, at minimum, 30 occupations specified in the Request for Proposal (RFP). The extent to which profiles of these specified health occupations were created and the extent to which supply and demand analyses had been conducted varied among the four provinces (Table 4). Of the 30 health occupations, only seven were forecasted in all four provinces. The results are summarized in Table 5.

The following assumptions are made with respect to providing a roll-up of Atlantic Region forecasts for the seven health professions:

[3] The same consulting firm conducted the PEI and NB studies.

- The forecasts provided in the Phase I reports are summative even though the methodologies differ; and

- The forecast for the Atlantic Region is for 2007. Where data was provided for other years (Prince Edward Island – 2006; Nova Scotia – 2008), the assumption was made that the forecasted number would also apply to 2007.

Licensed Practical Nurses

There is no surplus or shortage indicated for Newfoundland & Labrador, however, the remaining three provinces indicate that there will be a shortage of this profession. The total shortage in Atlantic Canada is projected to be 177 licensed practical nurses in 2007.

Medical Laboratory Technologists

The forecasts range from a shortage of in Nova Scotia, New Brunswick and Prince Edward Island to a potential surplus in Newfoundland & Labrador. The total shortage of medical laboratory technologists in the Atlantic Region ranges from 238 to 249 in 2007.

Medical Radiation Technologists (Radiological Technologists; Nuclear Medicine Technologists; and Radiation Therapists)

Newfoundland & Labrador and Prince Edward Island forecast a potential surplus, whereas New Brunswick and Nova Scotia predict a shortage. The net projection is a shortage of 122 to 148 medical radiation technologists in Atlantic Canada in 2007.

Occupational Therapists

The forecasts ranged from a surplus in Prince Edward Island and Nova Scotia to a shortage in New Brunswick and Newfoundland & Labrador. The implication for Atlantic Canada is a net shortage of 24 to 34 Occupational Therapists in 2007.

Physiotherapists

A shortage of physiotherapists is projected in all provinces except Nova Scotia in 2007. An overall shortage between 11 and 74 physiotherapists is projected in Atlantic Canada.

Registered Nurses

All four provinces projected that there will be shortages of registered nurses in 2007. The roll-up of these shortages predict a shortage of 2475 registered nurses in Atlantic Canada.

Social Workers

All provinces forecasted a potential shortage in supply. In 2007, the total shortage forecasted for Atlantic Canada is 330 Social workers.

Table 4: Occupations Reported in Phase I Studies Compared to RFP Requirements.

Health Profession	NB	NL	NS	PEI
Audiologists	✓⌘	✓⌘	✓	✓
Chiropractors			✓	
Combined Lab/X Technologists				✓
Continuing Care Workers			✓⌘	✓
Dental Hygienists			✓	✓
Dentists			✓	✓
Denturists			✓	
Dieticians and Nutritionists	✓	✓⌘	✓⌘	✓
Dosimetrists	✓			
Health Managers		✓	✓	
Health Records Administrators/Technicians	✓⌘		✓	✓
Home Support Workers			✓⌘	✓
Licensed Practical Nurses	**✓⌘**	**✓⌘**	**✓⌘**	**✓⌘**
Medical Laboratory Technologists	**✓⌘**	**✓⌘**	**✓⌘**	**✓⌘**
Medical Radiation Technologists	**✓⌘**	**✓⌘**	**✓⌘**	**✓⌘**
Nurse Practitioners	✓			
Occupational Therapists	**✓⌘**	**✓⌘**	**✓⌘**	**✓⌘**
Orthotists				✓
Paramedics/EMTs	✓⌘		✓	✓⌘
Pharmacists	✓⌘	✓	✓⌘	✓
Physicians	✓⌘		✓	
Physiotherapists	**✓⌘**	**✓⌘**	**✓⌘**	**✓⌘**
Prothetists	✓			✓
Psychologists	✓	✓⌘	✓⌘	✓
Public Health Officers	✓⌘			✓
Radiation Therapists	✓⌘	✓⌘	✓⌘	✓
Registered Nurses	**✓⌘**	**✓⌘**	**✓⌘**	**✓⌘**
Respiratory Therapists	✓⌘	✓⌘	✓⌘	✓
Social Workers	**✓⌘**	**✓⌘**	**✓⌘**	**✓⌘**
Speech Language Pathologists	✓⌘	✓⌘	✓	✓⌘

✓ - Profiled ⌘ - Forecasted

Bold entries are those where forecasts were performed in all four reports.

Table 5: Atlantic Roll-Up of Professions Forecasted in all Four Phase I Provincial Reports.

Occupation	PEI	NB	NL	NS	Atlantic Region
Licensed Practical Nurse	-33	-91	0	-53	-177
Medical Laboratory Therapist	-12	-127	31 to 42	-141	-238 to -249
Medical Radiation Therapist	1 to 22	-86	5 to 10	-68	-122 to -148
Occupational Therapist	4	-41	-5 to -15	18	-24 to -34
Physiotherapist	-1 to -3	-64	-40 to 25	31	-11 to -74
Registered Nurse	-158	-1078	-149 to -201	-1090	-2475 to -2527
Social Worker	-33	-130	-68 to -144	-23	-254 to -330

Note: A positive value reflects a forecasted surplus; a negative value reflects a forecasted shortage.

Summary Conclusions and Identification of Gaps

The Atlantic Regional roll-up of Phase 1 data conducted in this analysis suggests there will be an overall shortage of all of the seven professions forecasted. However, it is important to note that in some of the professions, certain provincial forecasts indicate a surplus is possible. The reader is encouraged to be mindful of the forecasts in each province, and interpret them in light of the underlying methodology that generated the forecasts.

Further, and most significantly, it must be noted that this roll-up for the Atlantic Region may not provide meaningful numbers for regional HHR planning. This caveat emerges from an understanding of the implications of the varying methodologies used by the provinces.

All reports focus attention on the number of providers, or in some cases the number of FTEs, to indicate supply. However, health care services are produced and delivered by a mix of different human and non-human resources using various technologies (methods of production and delivery). As a result, the demand for health human resources is derived from the demand for health care services. Hence, a key determinant of the demand for human resources will be the quantity (and type) of services produced by human resources (i.e., productivity). Because individual health human resources do not produce health care services in isolation, their productivity will depend on the availability of other health care inputs (other human and non-human resources) (Birch, 2002; Birch, O'Brien-Pallas, Alksnis, Wang, Tomblin Murphy, & Thomson, 2003). None of the reports consider the relationship between number of providers and number of services or the possible impact of other health care resources on this relationship.

An underlying 'theme' of all the reports is the notion of demand for HHR as the construct against which the adequacy of estimated future workforce supply is or will be determined. While the discussion and presentation differ among the reports, the 'indicator' or summary measure that forms the basis for thinking about the adequacy of supply, with Nova Scotia being the exception, is the population-to-provider ratio. Although limitations of using the population-to-provider ratio are recognized in the Newfoundland & Labrador report, the ratio (which is essentially an indicator of supply, not demand) was nevertheless an important input for forecasting in all of the reports.

Each report comments on the importance of the changing demographic structure of populations for the demand for health care, something that the provider-to-population ratio is insensitive to (the noticeable exception is the New Brunswick physician report which adjusts expected billings for observed variations in billings by the age and sex of patients). Moreover, the NB and PEI reports both use the current provider-to-population ratio as an appropriate 'target' for planning future HHR supply even though this ratio differs between the two provinces. Nova Scotia utilizes population demographic changes overlaid by service utilisation. However, when this is not available it utilizes population-to-provider ratios as well.

Little attention is given to the need for care among populations as a separate and distinct concept. Although the reports in some places mention population needs, no attempt is made to incorporate this into the models used or to derive indicators of need for consideration in the analytical frameworks. Moreover, where the aging of the population is mentioned, this is presented as something that increases the future demand for care. However, this demographic shift is the result of age- and sex-specific health levels increasing and, hence, reductions in the average need for care within age/sex groups.

In none of the reports is consideration given to changes in needs (as opposed to changes in demographic mix) and the implications this would have for service requirements and, thus, human resource requirements. Even in the Nova Scotia report existing utilisation is used as an appropriate level of services not only for the needs of the current population but also for the needs of the future population. Hence, the plans are somewhat tautological (or self fulfilling) – the age and sex distribution of what is currently supplied is deemed to be what is (and what will continue to be) required on an age- and sex-specific basis. The only way aggregate 'requirements' increase is in accordance with the size of age-sex cohorts independent of what is happening to the levels of health and, hence, needs for health care in these cohorts – what Evans refers to as the 'illusions of necessity' (Evans, 1984).

If average needs per person fall over time, there will be too many providers to simply meet needs at current service standards. Under systems of care in which funding is related directly or indirectly to the quantity of services delivered, services are expanded independent of changes in needs for services. Moreover, this trend is exacerbated if provider productivity (average services per provider) also increases. Traditionally, the result has been that services per capita increase in order to maintain provider workloads and these higher levels of utilisation are then adopted as measures of demand for the next round of health human resources planning. Accordingly, although initial plans may have been based on assumptions of constant age- and sex-specific

utilisation per capita, application of these models supports an increase in utilisation per capita, which then becomes the basis for planning future health human resources (Birch and Maynard 1985)

CHAPTER 3 - PLANNING VARIABLES AND DATA REQUIREMENTS

Planning for health education/training programs is inextricably linked to health human resources (HHR) planning. In this chapter, we examine the data sources identified in each of the provinces that address the information requirements for HHR planning that were identified in the comparative analysis report. We then discuss how the available data can be combined to develop critical variables that will be required for HHR planning and, hence, for planning health education/training programs. Recommendations are made regarding variables that we plan to incorporate into the planning process, and the data that will be required from the provinces to construct those variables.

In the process of reviewing the provincial data sources and discussing them with the provinces, a great deal has been learned about how routine data sources such as payroll, management information system (MIS) and registration data can be organized, maintained and combined for HHR planning. In each of the provinces, innovative approaches have been employed, and there are strengths and weaknesses to each of the databases we examined. In this chapter, we also document the lessons learned, make recommendations to guide ongoing database development and planning for HHR, and note Atlantic inter-provincial data harmonization issues.

Methodology

The research team held teleconferences and face-to-face meetings with representatives from each of the provinces to discuss sources of data and information available for planning purposes. The HHR Planning Conceptual Framework was used to guide the process (O'Brien-Pallas, et al., 2001). The list of information requirements and data gaps identified in the comparative analysis report were used as a template. We initiated the process with a conference call and a request for an inventory of databases and data documentation that addressed the following components:

- Population health needs and service requirements,
- Supply of health providers,
- Financial variables,
- Management, organization and delivery of services,
- Resource deployment and utilisation, and
- Patient and provider outcomes.

These components were derived from the HHR Planning Conceptual Model (O'Brien-Pallas, Tomblin Murphy, Birch, Baumann, 2001), which had informed the analysis of the Phase 1 reports. After reviewing the documentation, we held face-to-face meetings with each of the provinces to review the data sources available, identify issues and resource requirements in accessing the data, and develop strategies for using the data to construct key planning variables that can be incorporated into the forecasting tool.

We sought to identify all information that addresses each of the components areas from the comparative analysis. The sources of information identified are tabulated in Appendices B - E. The information sources identified include databases as well as more qualitative information such as reports, previous analyses and policy documents. However, our primary purpose for this report was to identify quantitative data sources that could be incorporated into the forecasting/simulation tool (Vensim, 2002) we will be developing later in the project. We plan to incorporate a common set of variables into the forecasting tool, for multiple occupations, to model the implications of the size and duration of training programs under different demand, productivity and scope of practice scenarios. By providing input data into the model specific to each occupation (e.g. the size and duration of training programs, information on percent completing training programs, demographics of the provider population, and data on exit rates from the labour force), the model can be used to plan for different occupational groups.

It is important to emphasize that not all information needs identified in the comparative analysis can feasibly be incorporated into the forecasting tool we develop. Forecasting in HHR modeling has a poor track record because of invalid assumptions, complex processes, and the inability to anticipate changes that alter the system (Song & Rathwell, 1994). The systems dynamics simulation approach we are developing is a conceptual tool, not an effort to simulate all factors affecting HHR. Its primary value lies in integrating knowledge of different components of the system, improving understanding of the dynamics of the system, and enabling the rehearsing of strategies and policies to inform policy choices. Simulation models must proceed incrementally to incorporate increasing levels of complexity. Thus, we will include a subset of the information identified in the comparative analysis in the simulation models we develop. The subset included will be determined in part by knowledge of the importance of different factors, and their relevance in a policy environment. It will also be determined by the data available, and the feasibility of assembling that data given the time and resources available. In the absence of data for some variables in some professions, assumed values will be employed and the impact of uncertainty in these variables modeled. The final subset of variables included will be documented in the simulation model report scheduled for submission in November 2004.

In this chapter, we discuss the variables that we require for the simulation, and which involve the roll-up of databases maintained by the provinces or assembled as part of the Phase I studies. The data sources and measurement strategies that will be required to construct these variables are discussed. This report does not focus on information needs identified in the comparative analysis report that are not data base driven. For example, we do not address sources of information for scope of practise issues or models of care delivery. Information needs for more qualitative variables, such as these, will be addressed in other project steps such as the program inventory and the environmental scan. We do address information needs for variables such as the number and distribution of providers by group, and the number of graduates by program.

It should also be emphasized that the identification of final variables to be included in the simulation, their measurement, and the roll-up of data to construct them is an ongoing process. Thus, this section documents the current status of data and measurement, and will provide a valuable opportunity for reflection and feedback from the Steering Committee and the provinces.

Planning Variables and Data Sources

The planning variables and data sources are based on the HHR Conceptual Framework (O'Brien-Pallas et al., 2001).

POPULATION HEALTH NEEDS AND SERVICE REQUIREMENTS

Key variables

The key steps in this stage are the measurement of population health needs and the translation of these needs into health service requirements. The key difference between this approach and the approaches used in previous health human resource planning reports is that the analysis is based around the notion of the use-need relationship as opposed to the use per capita relationship. In this way the level and distribution of needs in the population is the core element of the analysis.

There are no 'gold standard' measures relating population health needs to service requirements. Instead, we shall pursue service requirements and the health human resource requirements to support these service requirements by adopting a standard of care approach and apply this standard of care to future scenarios concerning changes in age- and sex-specific needs. As a baseline, current levels of utilisation will be taken as a standard for meeting current needs. In this way observed use-need ratios are applied to the anticipated levels and distributions of needs in the future population.

It is not suggested that current standards are in any way optimal. Instead they represent a set of weights that can be amended at any time in order to reflect any identified gaps in service provision or inappropriate levels of utilisation relative to needs. However, it is beyond the scope of this project to determine 'gold standard' weights for the age-sex groups. In this project utilisation data are adopted only as a set of weights to be applied to independently measured levels of health status of age-sex groups in the population.

Similar to the other work carried out by the team, population health needs will be measured using direct measures of health that are generally independent of any influence of supply. These will fall into four categories, risks to health (e.g., smoking, obesity, diet etc), self-assessments of health (excellent, very good, good, fair, poor), mortality and morbidity. Measures of health risks and self-assessed health are available in the 2001 Canadian Community Health Surveys (CCHS) (Statistics Canada, 2001). Mortality data are available from official records of the registrar general. Morbidity data remains problematic since even in self-reported form, as recorded in population health surveys, diagnosis of a condition is often influenced by access to and use of providers (Smith, Sheldon, Carr-Hill, & Martin, 1994). Even where conditions are such that lifetime diagnosis is considered to be relatively complete within a population setting (e.g., heart disease or cancer), the stage in the development of the condition at which diagnosis occurs is likely to be influenced by the access to health care providers. Hence, morbidity data will be considered carefully in the context of consistency with observed patterns of other health

measures and levels of provision (Tomblin Murphy, O'Brien- Pallas, Birch, Kephart, et al., 2003; Tomblin Murphy, O'Brien-Pallas, Birch, Kephart, et al., 2004)

For projecting health service requirements of a profession, it is also necessary to project future health care needs (Birch & Chalmers, 1993; Eyles, Birch, and Newbold, 1993; Birch, Eyles, and Newbold, 1996). Changes in population demographics due to population growth and migration shift the distribution of the age-sex structure of the population, thus altering service requirements even if requirements by age and sex remain constant. There are significant differences in projected changes in age structure between the Atlantic Provinces. For example, the populations are aging at different rates. However, shifts in chronic disease patterns and changes in the health status of the population result in changes in the service requirements by age and sex as well. Survey data and other mortality/morbidity data also indicate significant differences in chronic disease trends and other health determinants between the Atlantic Provinces (Tomblin Murphy, O'Brien-Pallas, Birch, & Kephart, 2004). Thus, estimating health care needs for the future is subject to considerable uncertainty, and this uncertainty must be incorporated into planning.

Data Sources

We have identified a number of data sources that can be used to estimate population health needs, and most are relatively straightforward to roll-up for purposes of this study.

- Changes in population size and distribution of the population by age and sex are available from Statistics Canada population projections. Newfoundland & Labrador has undertaken their own set of provincial and sub-regional population projections that they feel provide a more realistic projection than Statistics Canada projections.
- Vital statistics data provide information on deaths by province, age and sex. We will assemble age- and sex-specific mortality rates by major causes of death. We will also compute standardized mortality rates and standardized premature mortality rates (deaths before age 75).
- Survey data provide an abundance of information useful for estimating health services need. The Canadian Community Health Surveys (CCHS) provide comparable survey data for all Atlantic Provinces. In addition, provincial health surveys in Newfoundland & Labrador (2001) and Nova Scotia (1995) provide additional data. Based on earlier work (Tomblin Murphy, 2004: Tomblin Murphy, O'Brien-Pallas, Birch, Kephart et al., 2003; Tomblin Murphy et al., 2004), we propose that we will assemble the following types of data from surveys:
    - Data on self reported assessments of health and general health status;
    - Data on the number and prevalence of self-reported chronic health conditions; and
    - Data on major risk factors for chronic disease.

As noted above, we shall pursue service requirements by adopting a standard of care approach that uses, as a baseline, current levels of utilisation by age, sex and health status with adjustments for recognized gaps in services and any areas of 'overprovision'. For example, we may use rates of acute care utilisation (e.g. resource intensity weighted hospitalizations) by age, sex and health

status (fair/poor health versus good/excellent) as the basis for projecting future need. Estimates of future need would assume that the age-sex-health status specific rates of acute care utilisation remain constant, but that the distribution of persons by age, sex and health status changes as a result of population ageing and improvements in health status. The data sources for describing baseline utilisation are discussed under the "Resource Deployment and Utilisation" section below.

Recommendations

Estimating population health needs and translating them into service requirements represents a significant challenge in terms of data acquisition and modeling. The team recommends rolling up the above data sources, along with utilisation data (see section on Resource Deployment and Utilisation" below), for purposes of estimating current and future service requirements. A variety of methods are being employed for needs-based estimates of service requirements, and considerable advances in data and modeling strategies are being made. However, there is no accepted best method. In this study, we will use a needs-based approach instead of the utilisation approach that was employed in the Phase I studies. The analysis will be based on the application of use-need ratios, as a measure of current standards of care, applied to the expected future size and distribution of needs in the population. Alternative estimates of future requirements will incorporate information and uncertainty in factors such as changing health care needs of the population, changing health technologies, and changes in staffing mix and scope of practice (Birch et al., 2003). We will also make recommendations regarding data requirements and modeling improvements that could be made in the future.

SUPPLY OF HEALTH CARE PROVIDERS

Key Variables

This component includes variables that describe the "stock" of health care providers, and the rates of entry and exit that change the size and composition of the stock over time. Variables describing the characteristics of the current stock of providers include age, sex, public versus private employment, and the supply of labour from the stock of providers[4]. The supply of labour includes whether the individual is currently involved in the provision of health care (i.e., participation in health care delivery as indicated by employment status) and the level of activity for those employed as measured by variables such as, the number of worked hours.[5] For forecasting, the stock of providers is projected forward in time based on a set of age- and sex-specific rates of entries and exits. These rates constitute a critical set of variables of interest. Persons enter the stock of providers by graduating from training programs and migration from other jurisdictions. They exit the stock through out-migration, retirement, death and disability.

[4] By the "stock" of providers, we refer to the number of persons eligible to practise the profession (e.g. the number of licensed professionals). This will include persons who are not part of the current supply of labour (i.e. they are not engaged providing services as a result of unemployment or employment in a non-service delivery role). The supply of labour refers to the number of persons engaged in service delivery, and is thus a subset of the stock.

[5] Labour supply could also be included under the section on "resource deployment and utilisation" below.

It is necessary to estimate the initial levels of these rates, and to conduct alternative forecasts based on potential changes in these rates over time. For modeling purposes, temporary absences from employment due to factors such as maternity leaves are not treated as exits and re-entries from the stock of providers. Temporary absences are best regarded as reductions in the supply of labour provided by the stock.

Data Sources

Through meetings with each of the provincial governments, we have identified a number of useful data sources that can be used to derive the variables. Each data source has strengths and weaknesses, but in combination provide the means of measuring the key variables of interest.

Registry data:

Normally obtained from licensing bodies and professional associations, these data describe the stock of providers according to a variety of characteristics such as age, sex, employment status, place/sector of employment, and level of labour force participation (e.g. full-time versus part-time). An advantage of registry data is that they capture professionals employed in both the public and private sectors (which public sector payroll data do not). However, information on the supply of labour activity is fairly general and not as detailed as payroll data. Labour activity information in registration data is based on self-report, and only captures status at the time of registration. Also, the categorizations used can be confusing. For example, workers may be classified as full-time, part-time or casual. However, casual refers to the contractual basis of employment, not the hours worked (i.e. a casual employee could be working full-time or part-time). The utility of these data also depends on the form in which they are available:

- An aggregate snapshot at a single point in time (i.e. number of registrants by age and sex) provides an initial distribution of the stock of providers that can be projected into the future, but does not permit the estimation of entry and exit rates. In many cases, a single snapshot is all that is available from the data collected as part of the Phase I studies.

- Aggregate snapshots from multiple, sequential years permit the estimation of net changes in the stock of providers by age and sex. Subject to assumptions about the relative magnitude of entry and exit rates at each age, these data can be used to obtain estimates of overall entry and exit rates.

- An individual-level database of providers constructed from multiple years of registry data provides the most useful and powerful data source to describe the stock of providers. Such a registry includes records for every provider who was ever in the stock over multiple years covered by the database. It includes a unique lifetime identifier for each provider, the date of initial registration, source of initial registration (e.g. new graduate, migrant), date of last registration, and changes in attributes across registration periods. New Brunswick has maintained an excellent database of this type for eight major health professions.

Payroll data:

Payroll data that have been aggregated from the individual payroll systems of the institutions and/or health authorities in the public sector provides another powerful source of data describing the stock of providers. However, its utility varies by profession depending on the percent of the stock that are employed in the public sector. For professions dominated by public sector employment (e.g. medical radiation technologists), it is a rich source of data on the supply of labour and the number of exits by type. Ideally, it can be combined with denominators derived from registration data to compute rates. Relative to registry data, payroll data provides more detailed data on labour activity and reasons for attrition from the labour force (e.g. long-term disability or retirement).

The usefulness of payroll data for HHR planning has been greatly enhanced in provinces such as Prince Edward Island and New Brunswick that have actively rolled-up and warehoused payroll data across health authorities for this purpose. Newfoundland & Labrador is also beginning to warehouse these data. The availability of using payroll data for planning in Nova Scotia is being determined. However, Nova Scotia will enhance this capacity through the new, province-wide management information systems that it is implementing.

Key disadvantages of this data source are that employee numbers are usually not unique across payroll systems, and they only include professionals who are employed in the public sector. Also, roll-up of such data across multiple payroll systems can be logistically difficult, and there can be errors in identifying particular professions since the data are organized by administrative unit.

Pension data:

Pension data can potentially be used to obtain data on age- and sex-specific rates of retirement by profession.

Group insurance data:

Group disability and life insurance data, and workers compensation data, can be used to obtain estimates of disability and mortality rates in the labour force.

For purposes of this study, we will be rolling-up a combination of registry data and payroll data to construct variables describing the numbers and attributes of the current and past stock of providers. The intent is to describe the stock of providers broken down by age and sex, and additional characteristics such as private versus public employment where feasible and relevant.

Table 6 summarizes the data sources and approach that will be used to estimate the stock of providers in each province. Because of differences in the types of data available, and the professions for which it has been collected, different data sources will be used depending on the province and profession. For example, New Brunswick has maintained registry databases,

jointly shared by the professional associations and the province for eight major professional groups. Because these databases are individual-level and combine data over multiple years (versus aggregated snapshots), they can be used to estimate the stock at any point in time covered by the data. Moreover, they can also be used to compute entry and exit rates from the stock of providers (see below). In other provinces, payroll data will be used to assist in the computation of the stock of providers. However, this is only feasible for professions dominated by public sector employment.

Exits from the stock of providers are described by age- and sex-specific exit rates. These "global" exit rates are a function of different types of exit that can be described by a series of component rates: out-migration, retirement, mortality and disability (out-migration would include those who leave the profession (e.g. don't renew their license), as well as those who move out of the jurisdiction to work). Of these, out-migration and retirement will be most influential in reducing the stock of providers. The global rate for a given age-sex group can be expressed as a sum of the component rates:

Global exit rates = retirement rate + out-migration rate + mortality rate + disability rate

In the Phase I studies, age-specific exit rates were not directly estimated. Retirement rates were either assumed (e.g., based on an assumption of the distribution of retirements by year after age 55), or projected based on pension eligibility. Thus, measurement of actual exit and retirement rates and the estimation of future rates will be an advantage of this study.

Similarly, additions to the stock of providers are described by a set of global age-specific entry rates, which can in turn be broken down into a series of component rates. The component rates of interest are in-migration rates and the rate of entry of new graduates. In-migration rates would include those who re-enter the profession as well as those who move from other jurisdictions.

Table 6 also shows the data and strategies that will be used to estimate exit and entry rates. Registration data for multiple years and payroll data provide the primary data sources that will be used to estimate exit and entry rates. Registration data provides the best means of estimating global exit and entry rates. Payroll data provide the best means of estimating the component exit rates for public employees, but are not very useful for estimating component entry rates. Other potential sources of data for estimating exit rates for public sector employees include pension data and data from group insurance plans (e.g. group life insurance and group long-term disability insurance, workers compensation). For example, Prince Edward Island has conducted analysis of workers compensation and long term-disability claims.

Table 6: Variables Describing the Stock of Providers: Data Sources and Measurement

PROVIDER DEMOGRAPHICS AND ATTRIBUTES		
Variable	**Data Sources**	**Measurement**
Number of potential providers (i.e. the "stock" of providers)	Registration data Payroll data	Separate subscripted variable for each province and provider group (by age and sex) **New Brunswick:** Use updated registry data from common registration systems for 8 major health professions (RNs, LPNs, OT, Physiotherapy, social workers, medical lab technologists, speech and language therapists, audiologists). For other professions, use Fujitsu data. **Newfoundland & Labrador:** Primary data source will be the Human Resources Indicator Survey (HRIS) data. This is amalgamated payroll data obtained from health board MIS data. Age will be estimated from the birth year field. These data include ONLY public employees, and thus do not capture private sector employees or members of the stock of providers that are not employed in service delivery. Also, unique IDs change if an employee moves between boards. To address the deficiencies in this data we will: 1. Use registry data where available. For nursing, we must adjust for fact that all students are required to register in their last year, even if they do not stay in the province. 2. We will explore using the number of persons by age employed at any time over a 1-2 year time window in the payroll data. Given that most unemployment spells are short, this will capture individuals who are unemployed for short spells of time. **PEI:** We will select among three data sources for each profession: 1. Fujitsu data can provide initial snapshots for each profession; although data is now out-of-date. 2. Updated registry data: PEI will see if they can provide us with more current registry data for some professions. 3. Payroll data: PEI's warehoused payroll data can provide more current counts for professions that are exclusively public sector. We will employ similar strategies as for Newfoundland & Labrador. **Nova Scotia** We will use supply data collected by the Health Care Human Resource Council for their Phase I report. This data are primarily obtained from registry data.
Employment status (employment defines the supply of labour)	Registration data Payroll data	Registration data for several professions (e.g. nursing) provides current employment status at the time of registration. "Unemployment" usually means not employed in the profession (i.e. the registrant may be employed in another occupation). Numbers from payroll data can be subtracted from registry data to identify percent employed in the private sector. Where all workers are employed in the public sector, this approach may be used to estimate the percent unemployed (PEI, NB, NL) Newfoundland & Labrador: surveys of graduates from provincial programs provide data on the percent that are residing in the province and are unemployed.

Table 6: Supply Variables: Data Sources and Measurement for Key Variables (continued).

Variable	Data Sources	Measurement
Worked hours (defines the level of labour activity of the labour supply)	Payroll data Registry data	Payroll data is the preferred source of information. Hours worked will be estimated as the worked hours. Where appropriate employees will be converted to annual full-time equivalent status by dividing the worked hours by 1950 hours of work per employee (PEI, NB). In Newfoundland & Labrador, data collected from payroll systems does not permit estimation of worked hours by age and sex. We will also estimate the ratio of worked to earned hours. Registry data that classifies registrants as full-time/part-time will be used where payroll data is not available or not appropriate (e.g. where we want to examine public and private employees and a significant percent are employed in the private sector). Full-time status will be coded as .9 FTE and part-time coded as .6 FTE.
Sector (public/private)	Payroll data Registry data	Numbers from payroll data can be subtracted from registry data to identify percent employed in the private sector. Registry data for some professions classifies public versus private sector employment. In NB, the actual employer is known.
PROVIDER EXIT RATES:		**Rates describing exits from the labour force due to factors such as retirement, disability, out-migration and death**
Variable	**Sources**	**Measurement**
Global Exit Rate	Payroll data Repeated registry snapshots Longitudinal registry data	Individual-level registration data for multiple years: Number of exits can be estimated by year of last registration. Sequential aggregate registry snapshots: Counts by single years of age over multiple years can be used to estimate net annual change in the stock by age (i.e. exit rate – entry rate). At older ages, inflows can be assumed to be zero for purposes of estimating retirement rates. Payroll data: For professions that are only public employment, exit rates can be estimated by payroll terminations. However, overestimation is a concern because change in employers within province (shifts between payroll systems) will be counted as exits.
Retirement Rate	Payroll systems Registration data Pension systems	Age-specific retirements for public employees can be estimated from consolidated payroll data in NB and PEI. Number of retirements over all ages can be estimated using NL data Use repeated snapshot data from registries (see global exit rate above), and compute retirements as all exits minus exits expected from mortality and disability. Pension systems should be able to provide data on public sector retirements by age and sex, but this has not been done in any of the provinces.

Table 6: Supply Variables: Data Sources and Measurement for Key Variables (continued).

Variable	Sources	Measurement
Disability Rates	Payroll data Workers compensation data Group long-term disability data	Age-specific disability and sick hours for public employees might be estimated from consolidated payroll data in NB and PEI. Global numbers (all ages) can be obtained in NL. PEI has generated data on disability using workers compensation data and data on LTD claims from group insurance. We are exploring whether provinces can provide counts by age and sex.
Mortality Rate	Payroll data Group life insurance	Mortality is a relatively small contributor to exits, so effort devoted to direct estimation will be limited. Population mortality rates by age, sex and province from Statistics Canada can be used. Payroll data may be used to estimate public sector terminations due to death Group life insurance data may be able to provide public sector deaths by age and sex.
ENTRY RATES:	**Rates describing entry into the stock of providers from training programs and in-migration**	
Variable	**Measurement**	**Sources**
Global Entry Rates	Registration data Payroll data	Individual-level registration data for multiple years: Number of entries can be estimated by year of first registration. However, in NL all nursing students are required to register, regardless of whether they stay in the province. Problem may extent to other provinces and professions. Registration for greater than 1 year may thus be required to be classified as a new registrant. Registry snapshots: Counts by single years of age over multiple years can be used to estimate net annual change in stock by age (i.e. exit rate - entry rate). Payroll data: For professions that are predominantly public employment, entry rates may be estimated by payroll additions. However, because of lack of unique identifiers across boards and institutions, entries may be overestimated.
In-migration Rate	Registration data	In some cases, registration data identifies new registrants from other jurisdictions. For example, New Brunswick is able to identify new registrants from other jurisdictions for some professions.
New Graduate Entry Rate	Registration data Surveys of graduates	In some cases, longitudinal registration data identifies new graduates or year of graduation Newfoundland & Labrador: surveys of graduates from provincial institutions provide data on the percent entering local labour force and remaining in province.

Individual-level registration data, over multiple sequential years, provides the most straightforward means of estimating the global exit and entry rates from the labour force. Repeated aggregate snapshots of registration files that provide number of providers by single year of age and sex can be used to estimate global net (entry minus exit) rates. Since it can be reasonably assumed that the entry rate at retirement ages is close to zero, this approach can be used to estimate exit and retirement rates in the older age groups. For example, the number of 59 year-olds in 2002 minus the number of 60 year-olds in 2003 can be interpreted as the number of exits. This is a reasonable assumption at older ages, which are dominated by retirement, but not at younger ages where exits are offset by entries. At younger ages, this method only provides a net rate (i.e. entry rate minus exit rate).

As mentioned, public sector payroll data do not include the entire health care labour supply; it only contains those employed in the provision of health care in the public sector. However, it provides the best generally available source of information for estimating the component exit rates. In Prince Edward Island and New Brunswick, for example, the payroll data includes reason for termination from payroll, including retirement and long-term disability. Newfoundland & Labrador payroll data can also be used to estimate component exit rates, but not by age.

Recommendations

- Provinces should work with professional associations to incorporate multiple, sequential years of registry data into individual-level databases of registered health professionals that monitor the stock of health professionals on an ongoing basis. The files should incorporate a unique identifier for each registrant, and capture changes in registration status and attributes over time. New Brunswick has established a database that meets these criteria. The province and associations maintain the database jointly. The maintenance of a file of only current registrants or routine provision of aggregated snapshots of registrants fails to capitalize on the potential for registry data.

- If an individual-level file from registration data cannot be constructed or accessed, then aggregated snapshots of registry data that provide numbers by single years of age should be obtained on at least an annual basis. The snapshots should be by single years of age.

- Payroll data should be routinely compiled and warehoused across systems into an individual-level HHR database of public sector employees. The data should include information on all earned hours including worked hours (regular, overtime, relief, etc) and benefit hours (sick, annual leave, etc) and also unpaid hours (unpaid sick, maternity, etc)

- Provinces should work to incorporate a unique employee number across payroll systems. A unique employee identification number would avoid double counting persons employed in multiple institutions/boards, and would greatly enhance the utility of payroll data for HHR planning.

HHR Training And Production

Key variables

The key variables to be populated with rolled-up data include the following:

Attributes of training programs:

- Number of seats by year,
- Age of applicants entering programs
- Number of years required to complete program,
- Total tuition and fee costs, and
- Throughput:
    - Number of applications by year,
    - Percent of seats filled by year,
    - Program attrition rates by year, and
    - Number of graduates by year.

Attributes of graduates:

- Age and sex,
- Percent entering the stock of providers, and
- Average debt load by year.

Data Sources

Variables describing the attributes and experiences of training programs, with the exception of total program costs, were collected as part of the Phase I studies in each of the provinces. However, the time periods for which data are collected vary, and data have not continued to be collected on an ongoing basis.

Phase I data focused on the attributes of programs and was not routinely collected on the attributes of graduates. Nova Scotia has retention data on a few professions (physicians, dentists, pharmacists and occupational therapists). In Newfoundland & Labrador, the Department of Youth Services and Post-Secondary Education conducted a survey to follow-up the experiences of students who graduated from post-secondary institutions in the 1999-2000 academic year. Surveys were conducted from February to May 2002. This includes graduates of programs for bachelor of nursing, licensed practical nursing, home support workers, medical lab sciences, medical radiography and respiratory therapy. While the sample sizes and number of respondents per type of degree is small (e.g. 15 graduates of medical laboratory sciences), the surveys provide information on the labour market experiences of graduates, the percent of graduates leaving the province, the destination province of out-migrants, the time it took to get a full-time job, whether or not students had government student loans, and the average amount of their loans.

In Newfoundland & Labrador, nursing students are required to register in their final year of training. It is possible that the retention of new graduates might be estimated by the percent that renew their registration in the following year. However, this would not permit us to determine the percent that remain in the Atlantic Provinces. We will explore this option, and investigate whether the same option might work in other provinces and/or in other professions.

Given the number of entrants to the labour market who are new graduates (see discussion under "Supply of Health Providers" above), and the number of graduates from all Atlantic programs, the percent of graduates remaining in the province can be indirectly estimated. This estimate will be inflated to the degree that new graduates from outside of the Atlantic region are recruited into the labour force.

Recommendations

Attributes of training programs and graduates are critical variables required for the simulation component of this study. Phase I data elements are being requested. We will also attempt to indirectly estimate the percent of new graduates retained in the Atlantic Region using data on new entrants to the labour market and the number of new graduates.

FINANCIAL VARIABLES

Key variables of interest that can be assembled from available data include public expenditures on each provider group, and salaries and average earnings by provider. These data can be estimated from public sector payroll data from Prince Edward Island, New Brunswick and Newfoundland & Labrador. The ability to do this in Nova Scotia is still being investigated. Where possible, we will compute these variables by age and sex of employee.

MANAGEMENT, ORGANIZATION AND DELIVERY OF SERVICES

The information requirements identified under this category in the comparative analysis report will be addressed through the environmental scan.

RESOURCE DEPLOYMENT AND UTILISATION

Key variables

The current utilisation of services delivered by each professional group by demographic attributes of the population (e.g. by age and sex) is an important variable for this study. Resource deployment reflects the amount and nature of the resources deployed to provide the health services to the population at large, and utilisation reflects the nature and type of resources used by the population (O'Brien-Pallas, 2002). Utilisation data have often been used in HHR planning as a measure of the services required by the population for a particular type of health professional. However, utilisation does not include unmet needs (e.g. due to an inadequate supply of services), and it includes the delivery of inappropriate or ineffective services that are not needed (Carr-Hill, Smith, Martin, et al, 1994; Birch & Eyles, 1992; Birch, 2002). Utilisation

also reflects existing models of service delivery. Current patterns of utilisation may be a poor measure of need under alternative models of health services delivery employing different mixes of health professionals. Nevertheless, current patterns of utilisation can provide a baseline standard of care in current environments that forms a starting point for estimating the future health service requirements for a population and, hence, the future stock of particular health care professions in order to supply these service requirements using independent measures of population health needs (Tomblin Murphy, et al, 2003; Tomblin Murphy et al. 2004).

Utilisation data are also critical for considering the level of productivity of providers and, hence, the link between service requirements and health human resource requirements. The volume of services delivered by a group of health professionals defines their output. When divided by a measure of input (e.g. worked hours), the volume of services provides a measure of average productivity at the prevailing level of other inputs and technology. Changes in productivity will influence the health human resource requirements associated with any given level of health service needs (Birch et al., 2003).

Accordingly, key variables that we need include:

- The volume of services provided in each sector (e.g. acute care hospitals, long-term care institutions, and community care settings),
- Utilisation of provider groups by the population,
- The distribution of health care provider groups by sector, and
- Measures of productivity of each provider group.

Data sources

Data sources on the volume and utilisation of services by sector and provider group are shown in Table 7. Ideally, utilisation data should be available by age and sex of patients, and where utilisation data are specific to a provider group, it should be by age and sex of provider as well. For example, data from management information systems (MIS) do not permit the tabulation of utilisation by age and sex of patients, and thus are not useful for estimates of baseline service requirements. However, MIS data may be used to tabulate utilisation by age and sex of provider. Among the major health care sectors, the most complete data are available for acute care settings. The number of inpatient separations weighted by the Resource Intensity Weights (RIW) provides an overall measure of output. An increasing proportion of procedures and surgeries performed at acute care institutions are provided on an outpatient basis. These are also captured in CIHI's discharge abstract database (DAD); although, there may be inconsistencies between provinces in which types of visits are and are not included. Homecare utilisation data are not systematically collected in all of the provinces. Where direct hours are available, we need to determine if they can be tabulated by age and sex of patient.

The availability of utilisation data by profession is highly variable, and for many professions, comparable utilisation data are not available across the four provinces. Only New Brunswick has MIS data that includes workload measurement. Survey data from the Canadian Community Health Surveys (CCHS) provides a relatively easy access to a source of data for inpatient settings

and some health professional groups. However, it cannot be tabulated by attributes of providers. While the CCHS data are subject to self-report error, they have the advantage of being collected using a common methodology, cover both public and private sector utilisation, and are available at the individual patient level alongside data on socio-demographic and health status data. The Newfoundland & Labrador adult health surveys also collect data on self-reported utilisation; however, because they only measure use versus non-use (incidence), and not number of visits, the CCHS is the preferred data source for our purposes.

Payroll data provides a means of estimating the mix and distribution of health care providers by sector and setting. For example, these data can be used to compute the mix of nursing groups in acute care settings, individual institutions, or wards within institutions.

Productivity data are not generally collected. However, information on the average level of productivity for specific provider groups in particular settings (e.g., acute care hospitals) can be calculated as the ratio of outputs delivered to inputs provided. For example inpatient episodes of care per FTE registered nurse is one measure of average nursing productivity. However, because of differences in patients needs (e.g., severity) both between settings and over time, episodes of care have to be 'adjusted' for severity, using RIW, in order to provide a more homogeneous measure of output. For many other health care services data may be limited to 'crude' measures of outputs (e.g., physician visits). Differences in average visits, services or procedures per provider will still provide an indicator of differences in productivity, although this will need to be interpreted in relation to any qualitative information that might be available on average severity levels.

Recommendations

- We will explore the use of payroll data to generate data on the mix of employees by sector.
- CIHI data on RIW weighted and un-weighted inpatient separations and outpatient visits by age and sex will be requested from each province.
- CCHS data should be used as the primary source of data to estimate baseline service requirements for selected professional groups and sectors. Baseline service requirements will be partially based on summaries of utilisation by age and sex. Variation in age-sex utilisation by other attributes (e.g. health status and socio-economic variables) will also be useful. The selected sectors/ professions will include
    - Hospitals, long-term care and rehab,
    - Family physicians,
    - Dentists and orthodontists,
    - Physiotherapists/occupational therapists,
    - Psychologists,
    - Social workers,
    - Chiropractors,
    - Speech language therapists/audiologists, and
    - Registered Nurses.

- The research team will further explore the availability of utilisation data for the following professions as a basis for estimating baseline service requirements. The degree to which comparable data exist on number of services/procedures performed is not clear at this time:
    - Combined lab/X-ray technologists,
    - Medical laboratory technologists,
    - Medical radiation technologists,
    - Radiation therapists,
    - Respiratory therapists, and
    - Paramedics/ EMTs.

- To estimate service requirements for pharmacists, the research team will approach IMS Canada regarding a tabulation of the number of prescriptions filled by age, sex and year for Canada and the Atlantic provinces.

PATIENT OUTCOMES

Variables in this category describe population outcomes of care. Many indicators of health status and outcomes have been developed in Canada, and are available from a variety of secondary sources. Examples of general indicators of population outcomes include premature mortality rates, life expectancy, and health adjusted life expectancy. However, the relationship between population health outcomes and health care delivery is not straightforward, and general indicators of health such as these are more likely to reflect broader health determinants than the outcomes of care by health providers. Other routinely used indicators of outcomes are more specific to the health care system. Examples include hospital readmission rates and rates of avoidable admissions to hospital (e.g., admissions for ambulatory care sensitive conditions) (Tomblin Murphy, et al., 2003, Tomblin Murphy et al., 2004). While health system related, these indicators are still difficult to link to the care provided by specific professions. Indicators of outcomes of care for specific professions or procedures typically require specialized studies. We did not identify any sources of data that are likely to be useful for this study.

Table 7: Sources of Utilisation Data Identified by Sector and Profession

	New Brunswick	Newfoundland & Labrador	Nova Scotia	Prince Edward Island
Utilisation by Sector				
Acute - hospital	CIHI DAD data • RIW weighted inpatient separations • Outpatient visits • # Procedures by type CCHS – self-report inpatient days (combines acute, long-term and rehab)	CIHI DAD data • RIW weighted inpatient separations • Outpatient visits • # Procedures by type CCHS – self-report inpatient days (combines acute, long-term and rehab)	CIHI DAD data • RIW weighted inpatient separations • Outpatient visits • # Procedures by type CCHS – self-report inpatient days (combines acute, long-term and rehab)	CIHI DAD data • RIW weighted inpatient separations • Outpatient visits • # Procedures by type CCHS – self-report inpatient days (combines acute, long-term and rehab)
Acute – mental health	CIHI DAD • Inpatient days • Outpatient visits	CIHI DAD • Inpatient days • Outpatient visits	CIHI DAD • Inpatient days • Outpatient visits	CIHI DAD • Inpatient days • Outpatient visits
Long-term care	Resident days	Resident days	Resident days	*Potential source under assessment*
Homecare	Direct hours Number of visits	*Potential source under assessment*	Direct hours Number of visits	*Potential source under assessment*
Community/other	CCHS – consults with nurse in community	CCHS – consults with nurse in community	CCHS – consults with nurse in community	CCHS – consults with nurse in community
Utilisation by provider group				
General practitioners	• Fee-for-service claims and shadow billing • CCHS self-reported visits	• Fee-for-service claims (25% not paid FFS) • CCHS self-reported visits	• Fee-for-service claims and shadow billing • CCHS self-reported visits	• Fee-for-service claims and shadow billing • CCHS self-reported visits
Audiologists	CCHS (combined with speech and occupational therapists)- self reported visits	CCHS (combined with speech and occupational therapists)- self reported visits	CCHS (combined with speech and occupational therapists)- self reported visits	CCHS (combined with speech and occupational therapists)- self reported visits

Table 7: Sources of Utilisation Data Identified by Sector and Profession (continued).

	New Brunswick	Newfoundland & Labrador	Nova Scotia	Prince Edward Island
Utilisation by provider group (continued)				
Chiropractors	CCHS – self reported visits	CCHS – self reported visits	CCHS – self reported visits	CCHS – self reported visits
Combined Lab/X Technologists	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*
Continuing Care Workers	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*
Dental Hygienists	*Seeking sources*	*Seeking sources*	*Seeking sources*	*Seeking sources*
Dentists	CCHS – self reported visits	CCHS – self reported visits	CCHS – self reported visits	CCHS – self reported visits
Denturists	*Seeking sources*	*Seeking sources*	*Seeking sources*	*Seeking sources*
Dieticians and Nutritionists	*Seeking sources*	*Seeking sources*	*Seeking sources*	*Seeking sources*
Dosimetrists	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*
Health Managers	*Seeking sources*	*Seeking sources*	*Seeking sources*	*Seeking sources*
Health Records Administrators/Technicians	*Seeking sources*	*Seeking sources*	*Seeking sources*	*Seeking sources*
Home Support Workers	Direct hours Number of visits	*Potential source under assessment*	Direct hours Number of visits	*Potential source under assessment*
Licensed Practical Nurses	Seeking sources	Seeking sources	Seeking sources	Seeking sources
Medical Laboratory Technologists	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*
Medical Radiation Technologists	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*
Nurse Practitioners	*Seeking sources*	*Seeking sources*	*Seeking sources*	*Seeking sources*
Occupational Therapists	CCHS (combined with speech therapists and audiologists)- self reported visits	CCHS (combined with speech therapists and audiologists)- self reported visits	CCHS (combined with speech therapists and audiologists)- self reported visits	CCHS (combined with speech therapists and audiologists)- self reported visits
Orthotists	*Seeking sources*	*Seeking sources*	*Seeking sources*	*Seeking sources*

Table 7: Sources of Utilisation Data Identified by Sector and Profession (continued).

	New Brunswick	Newfoundland & Labrador	Nova Scotia	Prince Edward Island
Utilisation by provider group (continued)				
Paramedics/EMTs	*Potential source under assessment*	*Potential source under assessment*	Emergency Health Services – Ambulance dispatches	*Potential source under assessment*
Pharmacists	IMS data (prescriptions filled by age-sex group)	IMS data (prescriptions filled by age-sex group)	IMS data (prescriptions filled by age-sex group)	IMS data (prescriptions filled by age-sex group)
Physiotherapists	CCHS – self reported visits	CCHS – self reported visits	CCHS – self reported visits	CCHS – self reported visits
Prothetists	*Seeking sources*	*Seeking sources*	*Seeking sources*	*Seeking sources*
Psychologists	CCHS – self reported visits	CCHS – self reported visits	CCHS – self reported visits	CCHS – self reported visits
Public Health Officers	*Seeking sources*	*Seeking sources*	*Seeking sources*	*Seeking sources*
Radiation Therapists	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*	*Potential source under assessment*
Registered Nurses	*Seeking sources*	*Seeking sources*	*Seeking sources*	*Seeking sources*
Respiratory Therapists	*Seeking sources*	*Seeking sources*	*Seeking sources*	*Seeking sources*
Social Workers	CCHS – self reported visits	CCHS – self reported visits	CCHS – self reported visits	CCHS – self reported visits
Speech Language Pathologists	CCHS (combined with occupational therapists and audiologists)- self reported visits	CCHS (combined with occupational therapists and audiologists)- self reported visits	CCHS (combined with occupational therapists and audiologists)- self reported visits	CCHS (combined with occupational therapists and audiologists)- self reported visits

PROVIDER OUTCOMES

These outcomes include the health status of providers, retention rates, turnover rates, sick time, work satisfaction, levels of burnout, and other affective responses to the work environment. Key variables of interest include days lost to injuries, days lost to sickness, and days lost to disability.

Consolidated payroll data in the provinces provides one source of data we are considering as a means to assess provider outcomes. These data provide information on worked versus earned hours, and include codes indicating paid sick leave. Payroll data also include codes indicating payroll changes due to disability leave and death. In our communications with the provinces, the accuracy and coding standards of these variables was uncertain, and we cannot yet determine whether such data can be aggregated over multiple provinces. Workers compensation data and long-term disability insurance data provides other potential data sources we are investigating for assessing provider outcomes.

SYSTEM OUTCOMES

These include the cost associated with the resources dedicated to health services. These include rates of hospitalization, home visits, amount of money spent on the various health sectors, the number of people treated in each health sector, case intensity, discharge efficiency, proportion of acute versus non acute care, outpatient/inpatient surgery rates, and occupancy rates. A variety of data sources were identified that capture system outcomes. Most are captured under other headings, such as utilisation and resource allocation, and thus we do not discuss additional data sources that will be rolled up under this section.

Exploring system outcomes is the primary purpose of the simulation modeling. The simulation modeling will explicitly model potential system outcomes of a variety of factors affecting the HHR planning process. For example, the simulations will explore the implications of changing health care needs on service requirements, the effect of changing provider demographics on the skill mix of the workforce, and the potential impact of changes in productivity. The contribution of health education/training programs will be incorporated into this model. Thus, the planning of such programs can be informed by the simulated impact on system outcomes.

CHAPTER 4 – STATUS AND MILESTONES FOR DATA ACQUISITION AND ROLLUP

The primary goal of the data acquisition and roll-up component of this project is to provide data inputs for the simulation planning tool. The simulation planning tool will include a working simulation model with a set of standardized input data sets contained in Excel spreadsheets. Thus, data acquisition and roll-up are fully integrated with the development of the simulation tool. The simulation model will be developed in Vensim (Vensim, 2002). Vensim is a modeling tool that allows planners to conceptualize, build, and run dynamic simulation models. Vensim was selected because of its programming flexibility, ability to handle complexity, its graphical interface, and its extendibility. Graphical tools provide an excellent communication tool, thus enhancing the ability to communicate model results, and support the engagement of multiple disciplines and policy makers in the simulation process.

Clearly, not all information and variables identified in the comparative analysis report or this report can be incorporated into the simulation tool. The complexity and detail of the simulation modeling is not only constrained by the availability of data, it is also constrained by the degree of complexity that can meaningfully be incorporated into the simulation. The systems dynamics simulation approach we are developing is a conceptual tool. Its primary value lies in integrating data and knowledge of different components of the system, improving understanding of the dynamics of the system, and enabling the rehearsing of strategies and policies to inform policy choices.

The simulation will include a subset of potential variables identified in the comparative analysis report. The subset included will be determined in part by knowledge of the importance of different factors, and their relevance in a policy environment. It will also be determined by the data available, and the feasibility of assembling that data given the time and resources available. In the absence of data for some variables in some professions, assumed values will be employed and the impact of uncertainty in these variables modeled.

In light of interdependence between the data roll-up and the simulation, the research team has recognized that development of the simulation tool is central to the selection of variables to be modeled, the measurement of variables, and thus the acquisition and roll-up of data. It also helps to guide areas of focus in other steps in the project, such as the inventory of training programs and the environmental scan. Accordingly, a major focus of the research team in June has been the development of a preliminary “layout” for the simulation. The layout includes:

- Preliminary decisions about the variables and relationships between variables to include in the model;
- The inclusion of variables and relationships in a simulation diagram (a graphical picture of the model);
- Operational definitions of model variables (how they will be measured/computed); and
- Data requirements to support variable construction.

The preliminary model "layout" will be presented and discussed with the Steering Committee at the July meeting. It is our expectation that data roll-up and simulation model development will continue to evolve over the course of the project.

Our work on the simulation model to date has been informed by the conceptual framework and by the inventory of available data and measurement strategies presented in this report. It has also informed this report – particularly issues of data measurement. For example, the needs-based approach to defining service requirements that we will employ was driven by discussions on the simulation model, and this in turn helped to define data requirements. Incorporating simulation model development into the data acquisition and roll-up process has set back the time lines of data requests relative to those specified in our initial proposal. However, as we stressed in our presentation to the Steering Committee in the May meeting, it is an approach that we consider to be prudent. It focuses the data acquisition process, thus eliminating inefficiencies that would result from collecting data that are not needed for the project, and helps to ensure that we do not fail to collect data that we need. Given the issues that have emerged regarding privacy and the logistics of data release, this is particularly important. It has also provided a framework that has helped us to identify data gaps and set priorities.

Data Requests and Acquisition

The research team is in the process of independently acquiring data or requesting data from the provinces for data elements that we have agreed will be incorporated into the simulation model. This includes the following data:

- Data are being acquired from the National Population Health Survey and the Canadian Community Health Survey to measure population health attributes and health services utilisation for selected professions. (Completion date: July 1, 2004.)

- Population projections by age and sex are being acquired from Statistics Canada and Newfoundland & Labrador. The Statistics Canada projections will be updated this fall when revised projections are scheduled for release. (Completion date: July 9, 2004.)

- Vital Statistics and census data are being acquired from Statistics Canada for each province. Mortality rates and premature mortality rates are being computed by province and for Atlantic Canada (Completion date: July 16, 2004).

- Registration data: Registration data are being requested from all provinces for all professional groups for which they are available. We are requesting at least two sequential years, and preferably five years of registration data for all professional groups for which registration data are available. The request specifies a preference for individual-level data with a unique identifier, date of first registration, source of registration, and last registration. If individual data are not available, aggregated snapshots by single years of age and sex are requested. The request also specifies data on

employment status and attributes by age and sex. (Target date for completion: August 31, 2004.)

- Payroll data from Newfoundland & Labrador, Prince Edward Island and New Brunswick for a minimum of two years. As with registration data, individual-level data with a unique identifier are preferred, although we are prepared to work with aggregate data. (Completion date: September 15, 2004.)

- Details on payroll data for Nova Scotia have still not been determined; although the most recent forecasting report indicates that the data we require have been collected. We are in the process of scheduling additional meetings to explore this further, and will also acquire payroll data from Nova Scotia if feasible. (Completion date: September 15, 2004.)

- We are investigating the potential of using workers compensation, group insurance and pension data. However, there is little experience with the use of these data, and the value added above payroll data is uncertain. Thus, we are not actively pursuing the use of these data at this time.

- Data on attributes of training programs are being assembled as part of the inventory of programs. (Completion date: September 15, 2004.)

- CIHI Discharge Abstract Data requests from the provinces include:
    - RIW weighted and un-weighted inpatient episodes by age and sex,
    - Counts of selected procedures by age and sex, and
    - Outpatient visits by age and sex.

  (Completion date: September 30, 2004.)

- Data on long-term care resident days by age and sex of client are being sought where such data are available. We are still investigating the availability of such data in some of the provinces (Table 7). (Completion date: September 30, 2004.)

- Data on direct hours and number of visits for home care services by age and sex of client are being sought where such data are available. We are still investigating the availability of these data in some provinces (Table 7). (Completion date: September 30, 2004.)

- Data on the number of visits to family practitioners by age and sex of patient are being sought.

- Data on total fee-for-for service billings (or equivalent for those on alternate payment) by age and sex of physician are being sought. (Completion date: September 30, 2004.)

- We will be approaching IMS Canada to see if we can acquire estimates of the total number of prescriptions filled by age and sex of patient over multiple years by province. IMS has collected and maintained a database on prescription purchase data collected from pharmacies, and is likely to have these data readily available.

- We are continuing to assess the availability of workload data from provincial MIS systems; however, we know that such data are not readily available or easily accessed in PEI or Newfoundland & Labrador. New Brunswick has MIS systems with workload measurement data, and Nova Scotia has limited workload MIS data. We are seeking these data by province and profession where feasible. We will request workload and productivity measures by age and sex of provider. (Completion date: September 30, 2004.)

Data roll-up will continue to proceed alongside simulation development. Data will be rolled up as they become available, and incorporated into versions of the simulation model. Data issues that arise will lead to simulation refinements, and model behaviour will lead to data refinements. Similarly, simulation model development will help to focus the inventory of education programs and the environmental scan steps in the project. At this point we anticipate completion of data roll-up by October 31, 2004, and completion of simulation model development by November 15, 2004.

APPENDIX A: REFERENCES

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APPENDIX B: NEW BRUNSWICK DATA SOURCES

Population Health		
Variables	**Sources**	**Comments**
Size of Population	Census data: Population Projections	Most population health variables can be extracted from Statistics Canada databases accessed through Dalhousie University.
Population by electoral tract or region	Census data: Population Estimates	
Age	Census, CCHS: DHHA_AGE	
Age in years going back 30 years	Census data	
Gender	CCHS: DHHA_SEX	
Gender crossed with age	Census, CCHS	
Determinants of health by age and sex	CCHS: INCADHH, EDUFDR10, PACADPA1, LBFADJST, GEOADCMA, GEOADUR2(5), DHHADLVG, SMKA_202, SMKA_05D, SMKADSTY, ALCA_1(2,3), ALCADTYP	
Health status by age and sex	CCHS: HUIADHSI, GENA_01	
Number of chronic conditions by age and sex	CCHS: CCADTOT	
Unusual population distributions	Census data	
Immigration	Census data CCHS: SDCA_2(3), SDCAGCB	
Emigration		
Location of emigration		
Provider Attributes	**Current distribution of providers by factors such as specialty, region, etc Includes all in labour force (employed and unemployed)**	
Variables	**Sources**	**Comments**
ID	Association data: Registration Number	Payroll data is available for about 8 professions going back to 1989. The most recent years have the most detail. Association data is available for 8 professions (RN, LPN, OT, PT, SLP, MLT, SW, AUD.) going back 8 years. Supply-side data collected for the Fujitsu report could be used as a snapshot for 2002 only.
Year	Association data: Registration Year	
Age	Association data: Year of Birth	
Sex	Association data: Gender	
Metro Status		
Regulation Status	Association data: Registrations status, Membership status	

Appendix B: New Brunswick Data Sources (continued)

Provider Attributes	**Current distribution of providers by factors such as specialty, region, etc Includes all in labour force (employed and unemployed)**	
Variables	**Sources**	**Comments**
Employment Status	Association data: Employed or seeking employment	
% Full-Time Equivalent	Association data: Approximated based on FT, PT status; HRDB	
Public/Private	Association data: Based on Employer	
Health Employment Sector	Association data: Service Location	
Hours Worked	Human Resources Database (HRDB) for public employees	
Specialty	Association data: Area of practice	
Labour Force Entry Date	Association data: Year of graduation	
Source of Entry	Association data: Registered in another province/country last year	
Termination Status	HRDB	
Reason for termination	HRDB	
Exit Rates		
Variables	**Sources**	**Comments**
Global Attrition Rate	Association data, HRDB	Global attrition rates can be attained by looking at multiple years of registration data. The Human Resources database (HRDB) contains reason for termination, but is only available for public employees.
Retirement Rate	HRDB	
Disability Rates	Association data, HRDB	
Mortality Rate	Statistics Canada	
Out-migration Rate		
Exit Labour Force		

Appendix B: New Brunswick Data Sources (continued)

Entry Rates		
Variables	**Sources**	**Comments**
Global Entry Rates	Association data: Registration Status HRDB	Global entry rates can be attained by looking at multiple years of registration data. Registration status identifies the individual as a renewal, a new graduate, or registered in another province or country in the previous year (but not for RNs).
Inter-Provincial In-migration Rate	Association data: Registration Status	
International In-migration Rate	Association data: Registration Status	
New Graduate Entry Rate – Atlantic	Association data: Year of Graduation, Prov/Country of Graduation, Registration Status	
New Graduate Entry Rate - other Canada	Association data: Year of Graduation, Prov/Country of Graduation, Registration Status	
New Graduate Entry Rate - international	Association data: Year of Graduation, Prov/Country of Graduation, Registration Status	
Employment		
Variables	**Sources**	**Comments**
Unemployment	Association data: Employed, Seeking Employment (in the profession)	Total workforce can be determined from registration data.

Appendix B: New Brunswick Data Sources (continued)

HHR Production	Information required by health care provider group	
Variables	**Source**	**Comments**
Entry requirements	Phase 1 Report	This information was captured for the Fujitsu Phase 1 Report, however there is not much information in the report or the documentation.
Number of training seats	Phase 1 Report	
Number of applications by discipline		
Number of years to complete program		
Academic qualifications at completion		
Number of student intakes		
Number of students enrolled		
Number of graduates by program, specialty and year		
Annual registration to maintain practice certificate		
Number of graduates getting full time positions		
Number of graduates who emigrate or immigrate		

Appendix B: New Brunswick Data Sources (continued)

Financial	**Data is needed for the last 10 years to establish trends**	
Variables	**Source**	**Comments**
Expenditure on each provider group by source	Phase 1 Report	Some of the financial variables can be taken from the Fujitsu report. The payroll data may be a better source as data is available back to 1989.
Provincial GDP	Stats. Can.	
Ministry of Health expenditure on health care by program	Phase 1 Report	
Ministry of Health expenditure on providers by provider and program	Data only available by program	
Salaries/average earnings per provider by type of provider	HRDB	
Average household disposable income	Census	
Prevalence of private insurance by coverage	Statistics Canada survey data	
Expenditure of Workers Compensation Boards	Association of WCB Boards	
Management, Organization and Delivery of Services		
Variables	**Sources**	**Comments**
Pay arrangements	Collective agreements	A provincial health plan is expected to focus on centralization of services (e.g. cancer registries). This plan is due to be released on June 9, 2004. Recently there has been a shift from hospitals to community health centres.
Scope of practice issues		
Models of care delivery by type of health sector		
Organization of services across and within disciplines		
Technology		
Geographic location of services and providers		

Appendix B: New Brunswick Data Sources (continued)

Resource Deployment and Utilisation		
Variables	**Sources**	**Comments**
Methods used to deploy resources by provider group		MIS data is collected by the health boards at the individual level and is aggregated to functional centre when sent to the Department of Health. Emergency and ambulatory clinics are not included. For emergency rooms, productivity is measured using visits by triage level and time of day.
Number, type, and mix of each healthcare provider group by sector and geographical location	MIS	
Volume of services provided in each sector	MIS, Physician Billings	
Extent of utilisation by provider group, sector and geographical location	MIS	
How is productivity measured? (i.e. relationship between workload and worked hours)	MIS, Workload and hours worked.	
Number of FTE's by year and discipline	HRDB for public sector employees only	
Ratios of FT, PT and casual	HRDB for public sector employees only	
Patient Outcomes		
Variables	**Sources**	**Comments**
Mortality rate	Vital Stats, DAD	
Number of complications by sector and location (for as many years as possible)	DAD	
Surgical Mortality	DAD	
Medical errors by discipline and sector		
Readmissions rates	DAD	

Appendix B: New Brunswick Data Sources (continued)

Provider Outcomes		
Variables	**Sources**	**Comments**
Days lost due to injuries		Information on sick leave and LTD may be available from the payroll system.
Health Status		
Total disability/death		
Burnout, stress, satisfaction		
Number of paid days for absence	HRDB for public sector employees	

APPENDIX C: NEWFOUNDLAND & LABRADOR DATA SOURCES

Population Health		
Variables	**Sources**	**Comments**
Size of Population	Econometric file (Finance Dept.): Population projections	Most population health variables can be extracted from Statistics Canada databases accessed through the Regional Data Centre at Dalhousie University. For population projections, NL has suggested that the projections done by the Department of Finance are more accurate.
Population by electoral tract or region	Econometric file (Finance Dept.): Population estimates	
Age	Census data CCHS: DHHA_AGE NL Adult Health Survey	
Age in years going back 30 years	Census data	
Gender	Census data CCHS: DHHA_SEX NL Adult Health Survey	
Gender crossed with age	Census data CCHS, NL Adult Health Survey	
Determinants of health by age and sex	CCHS: INCADHH, EDUFDR10, PACADPA1, LBFADJST, GEOADCMA, GEOADUR2(5), DHHADLVG, SMKA_202, SMKA_05D, SMKADSTY, ALCA_1(2,3), ALCADTYP	
Health status by age and sex	CCHS: HUIADHSI, GENA_01	
Number of chronic conditions by age and sex	CCHS: CCADTOT	
Unusual population distributions	Census data	
Immigration	Census data CCHS: SDCA_2(3), SDCAGCB	
Emigration	Income Accounts: Migration rate	
Location of emigration		

Appendix C: Newfoundland & Labrador Data Sources (continued).

Provider Attributes	**Current distribution of providers by factors such as specialty, region, etc Includes all in labour force (employed and unemployed)**	
Variables	**Sources**	**Comments**
ID	HRIS: Unique reference number (URN)	The Human Resources Indicator Survey (HRIS) (2001/02-2002/03) incorporates human resource data from each of the Health Boards in NL. The survey includes information on hours worked (i.e. regular, overtime, sick leave) summarized by job code, and payroll data for each individual employed by a particular board. The survey also includes the total number of separations and hires (both internal and external) by profession. Data on Managers could be obtained from the Management Audit conducted in 2002. Data are summarized by single years of age and gender. NL Payroll data is submitted by the health boards without demographic information and therefore cannot be summarized by age and sex.
Year	HRIS: PayDate	
Age	HRIS: BirthYear	
Sex	HRIS: Gender	
Metro Status	HRIS: Board Name	
Regulation Status	See Health Canada report on regulated professions in Canada	
Employment Status	Data available for employed individuals only.	
% Full-Time Equivalent	HRIS: TYPE (i.e. employment type: Permanent FT, Temporary PT, Casual)	
Public/Private	Only Public Employees	
Health Employment Sector		
Hours Worked	HRIS: Normalhours (includes regular, overtime and relief)	
Specialty	HRIS: Jobspec	
Labour Force Entry Date	HRIS: HIRE and Birthyear	
Source of Entry	HRIS: Hire Internal, Hire External	
Termination Status	HRIS: Separations (Total by profession)	
Reason for termination		
Exit Rates		
Variables	**Sources**	**Comments**
Global Attrition Rate	HRIS: Separations (Total by profession)	Specific attrition rates could be estimated by looking at all separations by year and making assumptions based on the age of the individual, i.e. Separation of 25-40 year olds probably due to relocation, separations of 55+ probably retirement.
Retirement Rate		
Disability Rates		
Mortality Rate		
Out-migration Rate		
Exit Labour Force		

Appendix C: Newfoundland & Labrador Data Sources (continued).

Entry Rates		
Variables	**Sources**	**Comments**
Global Entry Rates	HRIS: Hires (Total)	Total Hires are Health Board specific. If an individual moves from one board to another, they are given a new employee number and are considered to be an external hire.
Inter-Provincial In-migration Rate		
International In-migration Rate		
New Graduate Entry Rate - Atlantic		
New Graduate Entry Rate - other Canada		
New Graduate Entry Rate - international		
Employment		
Variables	**Sources**	**Comments**
Unemployment	Employment Insurance Data	Employment Insurance usage is available for RN's and LPN's for the years 1996-2000. General information on unemployment rates is available from Community Accounts.
HHR Production	**Information required by health care provider group**	
Variables	**Source**	**Comments**
Entry requirements	Phase 1 Report	Information Regarding HHR production variables can be determined from the post-secondary graduate surveys. Surveys were sent to graduates of Memorial University of Newfoundland & Labrador and the community colleges (Career Search) with a response rate of about 70%. Information regarding actual programs (i.e. number of seats, number of years to complete) will have to be obtained from the actual institutions.
Number of training seats	Phase 1 Report	
Number of applications by discipline		
Number of years to complete program	Career Search	
Academic qualifications at completion		
Number of student intakes		
Number of students enrolled		
Number of graduates by program, specialty and year	Career Search	

Appendix C: Newfoundland & Labrador Data Sources (continued).

HHR Production (continued)	Information required by health care provider group	
Variables	**Source**	**Comments**
Number of graduates getting full time positions	Career Search	
Number of graduates who emigrate or immigrate	Career Search	
Financial	**Data is needed for the last 10 years to establish trends**	
Variables	**Source**	**Comments**
Expenditure on each provider group by source	Salary details: Budgeted positions, Salary Docs Database	Salary details database contains salary data for budgeted positions down to classification code, but does not include overtime and casual workers. Finance has information on pension plans, LTD and sick leave, but does not have information on dental plans
Provincial GDP		
Ministry of Health expenditure on health care by program		
Ministry of Health expenditure on providers by provider and program	MIS	
Salaries/average earnings per provider by type of provider	Salary details data, HRIS: Response Dollars	
Average household disposable income	Income Accounts: Average Husband-Wife Family Income	
Prevalence of private insurance by coverage	Finance	
Expenditure of Workers Compensation Boards	Workplace Health and Safety Compensation Commission report has data on RN's and LPN's	
Management, Organization and Delivery of Services		
Variables	**Sources**	**Comments**
Pay arrangements		There have been policy changes with respect to service delivery (i.e. location of services, skill mix). These changes will be implemented over the next 6 months. About 35% of physicians are salaried.
Scope of practice issues		
Models of care delivery by type of health sector		

Appendix C: Newfoundland & Labrador Data Sources (continued).

Management, Organization and Delivery of Services		
Variables	**Sources**	**Comments**
Organization of services across and within disciplines		
Technology		
Geographic location of services and providers		
Resource Deployment and Utilisation		
Variables	**Sources**	**Comments**
Methods used to deploy resources by provider group		Most of this information is available from the provincial Meditech system, which is MIS compatible. More workload data is currently being supplied by the health boards. Data can be aggregated by functional centre. Information on age and sex is not available. Data has been collected from 1994, but from 1997-present the information is most complete. Hours worked and FTE measurements can also be obtained from the payroll system. Workload data is not available for salaried physician because they are not required to shadow bill.
Number, type, and mix of each healthcare provider group by sector and geographical location		
Volume of services provided in each sector		
Extent of utilisation by provider group, sector and geographical location		
How is productivity measured? (i.e. relationship between workload and worked hours)	HRIS: Earned hours	
Number of FTE's by year and discipline	HRIS: Normal hours, Paydate, Jobspec	
Ratios of FT, PT and casual	HRIS: Type	
Patient Outcomes		
Variables	**Sources**	**Comments**
Mortality rate (Deaths by cause, age, sex)	Vital Stats, DAD	NL Centre for Health Information has made some of its administrative health claims data available to Community Accounts.
Number of complications by sector and location (for as many years as possible)	DAD	

Appendix C: Newfoundland & Labrador Data Sources (continued).

Population Outcomes	**Data for the general population broken down by cases and sector**	
Variables	**Sources**	**Comments**
Surgical Mortality	DAD	
Medical errors by discipline and sector		
Readmissions rates	DAD	
Provider Outcomes		
Variables	**Sources**	**Comments**
Days lost due to injuries	HRIS: WHSCC Incidents	The Human Resource Indicator Survey contains information on Workplace Health and Safety Compensation Commission (WHSCC) incidents aggregated to the level of profession.
Health Status		
Total disability/death	WHSCC	
Burnout, stress, satisfaction		
Number of paid days for absence	Payroll data	

APPENDIX D: NOVA SCOTIA DATA SOURCES

Population Health		
Variables	**Sources**	**Comments**
Size of Population	Census data: Population Projections	Most population health variables can be extracted from Statistics Canada databases accessed through the Regional Data Centre at Dalhousie University.
Population by electoral tract or region	Census data: Population Estimates	
Age	Census data CCHS: DHHA_AGE	
Age in years going back 30 years	Census data	
Gender	Census data CCHS: DHHA_SEX	
Gender crossed with age	Census data CCHS	
Determinants of health by age and sex	CCHS: INCADHH, EDUFDR10, PACADPA1, LBFADJST, GEOADCMA, GEOADUR2(5), DHHADLVG, SMKA_202, SMKA_05D, SMKADSTY, ALCA_1(2,3), ALCADTYP	
Health status by age and sex	CCHS: HUIADHSI, GENA_01	
Number of chronic conditions by age and sex	CCHS: CCADTOT	
Unusual population distributions	Census data	
Immigration	Census data CCHS: SDCA_2(3), SDCAGCB	
Emigration		
Location of emigration		
Provider Attributes	**Current distribution of providers by factors such as specialty, region, etc Includes all in labour force (employed and unemployed)**	
Variables	**Sources**	**Comments**
ID	Supply Data: Personal Identifier	Information regarding Provider Attributes was obtained from the "Quality of Supply Data" report as issued by Health Care Human Resource Sector Council. This information reflects the data used in the Phase 1 Report and will need to be updated.
Year	Supply Data: Year of Data	
Age	Supply Data: Age	
Sex	Supply Data: Gender	
Metro Status	Supply Data: Postal Code	
Regulation Status	Supply Data: Registration Status	

Appendix D: Nova Scotia Data Sources (continued).

Provider Attributes (continued)	**Current distribution of providers by factors such as specialty, region, etc** **Includes all in labour force (employed and unemployed)**	
Variables	**Sources**	**Comments**
Employment Status	Supply Data: Primary Employer Name, Not Employed	
% Full-Time Equivalent	Supply Data: Employment Status	
Public/Private	Supply Data: Place of Work, Facility Type	
Health Employment Sector	Supply Data: Primary Area of Responsibility	
Hours Worked		
Specialty	Supply Data: Specialty	
Labour Force Entry Date	Supply Data: Initial Registration Year	
Source of Entry		
Termination Status		
Reason for termination		
Exit Rates		
Variables	**Sources**	**Comments**
Global Attrition Rate	*Under assessment*	
Retirement Rate		
Disability Rates		
Mortality Rate		
Out-migration Rate		
Exit Labour Force		
Entry Rates		
Variables	**Sources**	**Comments**
Global Entry Rates	*Under assessment*	
Inter-Provincial In-migration Rate		
International In-migration Rate		
New Graduate Entry Rate - Atlantic		
New Graduate Entry Rate - other Canada		
New Graduate Entry Rate - international		

Appendix D: Nova Scotia Data Sources (continued).

Employment		
Variables	**Sources**	**Comments**
Unemployment	*Under assessment*	
HHR Production	**Information required by health care provider group**	
Variables	**Source**	**Comments**
Entry requirements		The Occupational Summaries, Profiles and Issues document from the Phase 1 Report contains information on institution name, admission requirements, number of applicants, number of intakes, number of enrolments, and program duration for each profession.
Number of training seats		
Number of applications by discipline		
Number of years to complete program		
Academic qualifications at completion		
Number of student intakes		
Number of students enrolled		
Number of graduates by program, specialty and year		
Annual registration to maintain practice certificate		
Number of graduates getting full time positions		
Number of graduates who emigrate or immigrate		
Financial	**Data is needed for the last 10 years to establish trends**	
Variables	**Source**	**Comments**
Expenditure on each provider group by source		
Provincial GDP		

Appendix D: Nova Scotia Data Sources (continued).

Financial (continued)	Data is needed for the last 10 years to establish trends	
Variables	**Source**	**Comments**
Ministry of Health expenditure on providers by provider and program		
Salaries/average earnings per provider by type of provider		
Average household disposable income	Census	
Prevalence of private insurance by coverage		
Expenditure of Workers Compensation Boards		
Management, Organization and Delivery of Services		
Variables	**Sources**	**Comments**
Pay arrangements		
Scope of practice issues		
Models of care delivery by type of health sector		
Organization of services across and within disciplines		
Technology		
Geographic location of services and providers		
Resource Deployment and Utilisation		
Variables	**Sources**	**Comments**
Methods used to deploy resources by provider group		MIS data is currently being collected in many jurisdictions in Nova Scotia. It will have to be determined how many Health Authorities are using meditech and which years of data are available.
Number, type, and mix of each healthcare provider group by sector and geographical location		
Volume of services provided in each sector		

Appendix D: Nova Scotia Data Sources (continued).

Resource Deployment and Utilisation (continued)		
Variables	Sources	Comments
How is productivity measured? (i.e. relationship between workload and worked hours)		
Number of FTE's by year and discipline		
Ratios of FT, PT and casual		
Patient Outcomes		
Variables	**Sources**	**Comments**
Mortality rate	Vital Stats, DAD	
Number of complications by sector and location (for as many years as possible)	DAD	
Surgical Errors	DAD	
Medical errors by discipline and sector		
Readmissions rates	DAD	
Provider Outcomes		
Variables	**Sources**	**Comments**
Days lost due to injuries		
Health Status		It will have to be determined if payroll systems contain data regarding sick leave and LTD.
Total disability/death		
Burnout, stress, satisfaction		
Number of paid days for absence		

APPENDIX E: PRINCE EDWARD ISLAND DATA SOURCES

Population Health		
Variables	**Sources**	**Comments**
Size of Population	Census data: Population Projections	Most population health variables can be extracted from Statistics Canada databases accessed through the Regional Data Centre at Dalhousie University.
Population by electoral tract or region	Census data: Population Estimates	
Age	CCHS: DHHA_AGE	
Age in years going back 30 years	Census data	
Gender	Census data CCHS: DHHA_SEX	
Gender crossed with age	Census data CCHS	
Determinants of health by age and sex	CCHS: INCADHH, EDUFDR10, PACADPA1, LBFADJST, GEOADCMA, GEOADUR2(5), DHHADLVG, SMKA_202, SMKA_05D, SMKADSTY, ALCA_1(2,3), ALCADTYP	
Health status by age and sex	CCHS: HUIADHSI, GENA_01	
Number of chronic conditions by age and sex	CCHS: CCADTOT	
Unusual population distributions		
Immigration	Census data CCHS: SDCA_2(3), SDCAGCB	
Emigration		
Location of emigration		
Provider Attributes	**Current distribution of providers by factors such as specialty, region, etc Includes all in labour force (employed and unemployed)**	
Variables	**Sources**	**Comments**
ID	Payroll: Emp_Num	For all public employees, we can use the payroll system. For the privately employed, we will have to access registration data from the licensing bodies. The breakdown for all health employees is about 80% public and 20% private. The Fujitsu database can be used as a snapshot.
Year	Payroll: PP_End_Date	
Age	Payroll: Birth_date	
Sex	Payroll: Gender	

Appendix E: Prince Edward Island Data Sources (continued).

Provider Attributes (continued)	**Current distribution of providers by factors such as specialty, region, etc Includes all in labour force (employed and unemployed)**	
Variables	**Sources**	**Comments**
Regulation Status	Registration Data: Association ID	
Employment Status	Payroll: Status Registration Data: Employment Status	
% Full-Time Equivalent	Payroll: NFTE	
Public/Private	As determined by data source (i.e. payroll = public)	
Health Employment Sector		
Hours Worked	Payroll: Reg_hours_yt, Ot1_hours_yt, Ot2_hours_yt, Rel_hours_yt, Shft_hours_yt, Cb1_hours_yt, Cb2_hours_yt, Pd_hours_ytd	
Specialty		
Labour Force Entry Date	Payroll: Hire_Date and Service	
Source of Entry		
Termination Status	Payroll: Term_Date	
Reason for termination	Payroll: Term_class	
Exit Rates		
Variables	**Sources**	**Comments**
Global Attrition Rate	Payroll: Term_Date	Potential sources for attrition rates are group life insurance and pension systems. Note: Retired nurses are allowed to return to work on a casual basis without effecting their pensions.
Retirement Rate	Payroll: Term_class Health Resource Employee Data: Projected retirement listing	
Disability Rates	Payroll: Sick_hours_y, Term_class	
Mortality Rate	Payroll: Term_class	
Out-migration Rate		
Exit Labour Force		
Entry Rates		
Variables	**Sources**	**Comments**
Global Entry Rates	Payroll: Hire_Date	
Inter-Provincial In-migration Rate		

Appendix E: Prince Edward Island Data Sources (continued).

Entry Rates (continued)		
Variables	**Sources**	**Comments**
International In-migration Rate		
New Graduate Entry Rate - Atlantic	Registration data	
New Graduate Entry Rate - other Canada		
New Graduate Entry Rate - international		
Employment		
Variables	**Sources**	**Comments**
Unemployment		
HHR Production	**Information required by health care provider group**	
Variables	**Source**	**Comments**
Entry requirements	Requirement Table: Entrance_requirement	While the PEI Phase 1 report provides some information regarding the number of training seat available, the documentation compiled by Fujitsu indicates that the HHR production data is very complete. Included are variables describing entry requirements, number of intakes, number of enrollments, number of PEI enrollments, the number of graduates over the past 10 years, the name and location of the institution, and the training duration.
Number of training seats	Phase 1 Report	
Number of applications by discipline		
Number of years to complete program	Program Table: Training_duration	
Academic qualifications at completion	Program Table: Credential_CD	
Number of student intakes	Program Table: Program_capacity	
Number of students enrolled	Program Table: Number_of_enrolments, Number_of_PEI_Students	
Number of graduates by program, specialty and year	Program Table: Number_of_graduates_last_10_years	
Annual registration to maintain practice certificate		
Number of graduates getting full time positions		
Number of graduates who emigrate or immigrate		

Appendix E: Prince Edward Island Data Sources (continued).

Financial	**Data is needed for the last 10 years to establish trends**	
Variables	**Source**	**Comments**
Expenditure on each provider group by source		
Provincial GDP		
Ministry of Health expenditure on health care by program		
Ministry of Health expenditure on providers by provider and program	Payroll: Pd_hrs_ytd, BOG	
Salaries/average earnings per provider by type of provider	Payroll: Reg_yy_sal, BOG	
Average household disposable income	Census	
Prevalence of private insurance by coverage		
Expenditure of Workers Compensation Boards	Worker's Compensation Report	
Management, Organization and Delivery of Services		
Variables	**Sources**	**Comments**
Pay arrangements		
Scope of practice issues		
Models of care delivery by type of health sector		
Organization of services across and within disciplines		
Technology		
Geographic location of services and providers		

Appendix E: Prince Edward Island Data Sources (continued).

Resource Deployment and Utilisation		
Variables	**Sources**	**Comments**
Methods used to deploy resources by provider group		
Number, type, and mix of each healthcare provider group by sector and geographical location	Payroll	
Volume of services provided in each sector		
Extent of utilisation by provider group, sector and geographical location		
How is productivity measured? (i.e. relationship between workload and worked hours)		
Number of FTE's by year and discipline	Payroll: NFTE	
Ratios of FT, PT and casual	Payroll: Status	
Patient Outcomes		
Variables	**Sources**	**Comments**
Mortality rate (Deaths by cause, age, sex)	Vital Stats, DAD	
Number of complications by sector and location (for as many years as possible)	DAD	
Surgical mortality	DAD	
Medical errors by discipline and sector		
Readmissions rates	DAD	

Appendix E: Prince Edward Island Data Sources (continued).

Provider Outcomes		
Variables	**Sources**	**Comments**
Days lost due to injuries	Payroll: Sick_hrs_y, Term_class	
Health Status		
Total disability/death	Payroll: Term_class	
Burnout, stress, satisfaction		
Number of paid days for absence	Payroll: Sick_hrs_y	