ATLANTIC Health

Human Resources Planning study

EXECUTIVE SUMMARY

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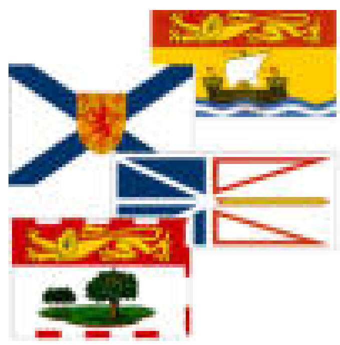
Submitted to:

Atlantic Health Human Resources Association



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September 30, 2005

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Glossary of Terms Used in This Report

***Activity-Adjusted Providers**: A* description of a group of providers which takes into account the distribution of worked hours of the group. It can be thought of as being analogous (but not equivalent) to full-time equivalent (FTE) providers.

Entry to the Stock**:** Providers registering in the local stock who were not registered in the previous year. These new registrants are assumed to come either from training programmes in the region (graduate entry) or from other regions (in-migration).

Exit from the Stock: Providers not registering in the local stock who were registered in the previous year.

Future Years: Any year following the baseline year of 2002.

General Simulations: Simulations aimed at understanding the behaviour of the model generally (i.e., across professions) and identifying broad implications for the effects of particular elements of the model in the context of the operation of the whole model.

Graduate out-migration: Proportion of new graduates who leave the Atlantic Region on graduation.

In-migration**:** New entrants from outside of the Atlantic Region.

Intensity of Work**:** Proportion of worked hours given to direct patient care.

Level of Activity**:** Number of hours spent in the delivery of service (i.e. worked hours).

Level of Service**:** The services deemed appropriate to address the given level of need by age and sex (e.g., as measured by health status).

Participation Rate: The proportion of the stock that are involved in the delivery of patient care (i.e., level of activity is not zero).

Productivity**:** Average rate of service delivery per hour of work among those providers with activity levels greater than zero.

Profession-Specific Simulations: Simulations testing the relative and cumulative effectiveness of various policy scenarios on eliminating the gap between the requirement for and supply of members of a specific profession.

Programme Attrition Rate: Proportion of students entering training programmes but not graduating.

Provider Gap: The difference between the requirement for and supply of members of a profession. Negative values refer to a shortage while positive values refer to a surplus.

Provider-to-Need**:** The required number of activity-adjusted providers divided by the size of the population in a particular level of health status (e.g., the population with cancer, diabetes, hearing problems).

***Provider-to-Population*:** The number of activity-adjusted providers over the size of the population (regardless of health status).

Resource Intensity Weights: The RIW system is a relative resource allocation methodology for estimating a hospital's inpatient-specific costs for both acute and day procedure care. RIW are used to standardize the expression of hospital case volumes, recognizing that not all patients require the same health care resources. Volume is then expressed as 'weighted cases'.

***Seats*:** The annual number of admissions to the training programme.

***Self-Assessed General Health Status*:** Assessment of personal health (as poor, fair, good, excellent) by respondents to a health survey.

***Stock of Providers*:** The number of individuals in the existing population that are potentially available to provide health care services. This includes all individuals with the appropriate license or registration for a particular health care profession irrespective of whether the individual is currently active in the delivery of health care services.

***System Dynamics Simulation Approach*:** Simulation approaches are aimed at understanding the dynamics of factors affecting future Health Human Resources (HHR) supplies and requirements. Simulation is conducted to understand how different components of the HHR system interact with each other over time, and to understand the relative impact of different policies including short-term versus long-term approaches to HHR policy interventions. In this way system dynamic simulations provide insights on how to adjust the system to address current and emerging problems.

Acronyms

AHHRA - Atlantic Health Human Resources Association
AHHRPS - Atlantic Health Human Resources Planning Study
CAMRT - Canadian Association of Medical Radiation Technologists
CAOT - Canadian Association of Occupational Therapists
CAPO - Canadian Association of Prosthetists and Orthotists
CASPLA - Canadian Association of Speech Language Pathologists and Audiologists
CCA - Continuing Care Assistant
CCHS - Canadian Community Health Survey
CCHSE - Canadian College of Health Service Executives
CE - Continuing Education
CFPC - College of Family Physicians of Canada
CHIMA - Canadian Health Information Management Association
CHRA - Canadian Health Records Association
CIHI - Canadian Institution for Health Information
COPD - Chronic Obstructive Pulmonary Disease
CPA - Canadian Psychologists Association
CSMLS - Canadian Society of Medical Laboratory Science
CT - Combined Technologist
DAD - Discharge Abstract Database
DH - Dental Hygienist
DN - Dieticians and Nutritionist
EMT - Emergency Medical Technician
ETP - Entry-to-Practice
FP - Family Physician
HCA - Health Care Aide
HHR - Health Human Resources
HM - Health Manager
HSW - Home Support Worker
LPN - Licensed Practical Nurse
LPNDB - Licensed Practical Nurse Database
MLT - Medical Laboratory Technologist
MRT - Medical Radiation Technologist
NBCC - New Brunswick Community College
NBCC-SJ - New Brunswick Community College-St. John
NP - Nurse Practitioner
NPHS - National Public Health Survey
NSCC - Nova Scotia Community College
OT - Occupational Therapist
PACS - Picture Archive and Communication System
PHC - Primary Health Care
PHO - Public Health Officer
PT - Physiotherapist
RCW - Resident Care Worker
RN - Registered Nurses
RNDB - Registered Nurse Database
RT - Respiratory Therapist
SLP - Speech Language Pathologist
SW - Social Worker
URR - Underserved, Remote and Rural

Acknowledgements

We would like to express our appreciation for the involvement of the Steering Committee in this project. The Committee members engaged us in many frank discussions and provided very constructive input, feedback and direction. We learned from each other and throughout the process developed strong collegial relationships. Their input ensured a strong return on the resources invested in this project.

We would also like to acknowledge the staff of the Ministries of Health and Education of each of the four Atlantic Provinces. Our discussions with the staff familiar with the data requirements of this study were invaluable. Their knowledge of the availability of relevant data and the quality of the data certainly, in our view, constitutes a strong resource base for planning in each of the Ministries. The policy-oriented staff provided a meaningful 'testing-board' for the policy scenarios analyzed by the simulation model developed in this study. The input of these staff persons was very much appreciated.

Finally, we are grateful to Statistics Canada and the Canadian Institute for Health Information (CIHI) for the provision of resident case data as well as data from the physician and nursing databases. In this context, we would like to especially thank Paul Sajan of CIHI for the support he provided to this work.

Introduction

Med-Emerg Inc. was retained by the Atlantic Health Human Resources Association (AHHRA) to conduct a regional health human resources (HHR) planning study for the four Atlantic Provinces (Nova Scotia, Newfoundland & Labrador, Prince Edward Island and New Brunswick). The goal of the Atlantic Health Human Resources Planning Study (AHHRPS) was to carry out a comprehensive study of the regional requirements for health professionals in Atlantic Canada, and the regional requirements for available educational/training programmes in and outside Atlantic Canada.

Issues in HHR planning have become a key challenge for policy-makers world wide. The Atlantic Deputy Ministers for Health and Education responded by creating the AHHRA as an administrative body tasked with directing this regional planning study, and setting the scope of the study to include 30 health provider groups. Further, they established a steering committee of representatives from the Ministries of Health and Education in each of the Atlantic Provinces. This represents a unique regional collaboration of health and education in HHR planning.

The specific objectives of the project were to develop a simulation model that would allow the Atlantic Region to simulate gaps in the supply of and need for HHR, and to test the effectiveness of policy initiatives in dealing with HHR gaps prior to the full implementation of the policy intervention. The information generated by this study will provide the background needed to ensure balanced, well prepared health care and health education strategies for Atlantic Canada.

In order to meet the key objectives of this study, seven deliverables were provided. They included the following:

1. Conducted an environmental scan of health education/training issues;
2. Compiled an inventory of health education/training programmes;
3. Compiled an inventory of continuing health education/training programmes;
4. Carried out a comparative analysis of the previous provincial (Phase I) studies;
5. Rolled-up data contained in those provincial supply and demand studies;
6. Developed a reusable, scenario-based education/training planning tool, and
7. Populated the planning tool and made recommendations on how to address any identified shortages or surpluses in training capacity predicted for the specified occupations.

The environmental scan included a summary of the peer-reviewed and web-based (“grey”) literature as well as consultations with stakeholders including funders, educators, regulators, employers and unions. The goal of the environmental scan was to identify education/training issues and trends impacting on the supply of and need for health education/training programmes. The report was entitled *Trends and Issues in Health Education/Training* (Tomblin Murphy et al, 2005). Topics covered in the report included the following:

- Educating for Changing Health Care Delivery Models,
- Education and Credentialing,
- Certification, Licensure and Scope of Practice,

- Recruitment and Retention of Students and Faculty,
- French Language Health Service Delivery,
- Education/Training for Underserved Rural Communities, and
- Formal Continuing Education.

The most prominent specific issues were the momentum toward interprofessional education for collaborative practice, the increasing entry-to-practice credentials in some professions, and the shrinking population of young people to recruit into the health profession training programmes. The scan provided information on which some of the model assumptions and simulation scenarios were based. The issues raised and addressed will continue to have an impact on HHR in Atlantic Canada for years to come.

The development of an inventory of health education/training programmes encompassed both deliverables two and three. The education/training programmes included were those that were offered in both official languages primarily in Atlantic Canada (including current seat purchase agreements outside the region). It also included formalized continuing education/training programmes, offered in both official languages. Formal continuing education/training programmes are those required for certification, advancement, or specialization of the existing workforce. These courses are offered for specified health disciplines in Atlantic Canada and outside Atlantic Canada. The report for these deliverables was entitled *Inventory of Atlantic Health Education and Training Programmes* (Ranganthan and Alder, 2004).

The inventory will be useful in many ways for HHR planning. Critical however, is that it provides a database of all relevant education programmes in the region which, if maintained will relevant statistics on the student population. As part of this deliverable Med-Emerg created an online education database which will allow planners and educators to access and update educational data for the Atlantic Provinces. This online tool can also be accessed by students interested in learning more about the health education programmes in their region.

The fourth deliverable involved the analysis and synthesis of recent studies undertaken by each of the Atlantic Provinces' Ministries of Health. These studies constituted Phase I of AHHRA's two-phase project; the current study constitutes Phase II. The report for this deliverable, entitled *Comparative Analysis of Atlantic Health Human Resources Studies* (O'Brien-Pallas et al., 2004), compared the provincial studies on the following:

- Scope (public/private health sector occupations for which a supply and demand analysis has been conducted in each Atlantic province, number of years forecasted);
- Methodology;
- Key components (minimum data sets used by each province were compared to identify similarities and differences in data collection and forecasting models); and
- Findings by occupation (summarized gap analysis for each health occupation analyzed, major issues/trends identified by occupation).

Each of the Phase I studies conducted by the Atlantic Provinces adopted a forecasting approach. They estimated "supply/demand" gaps, and used forecasts to understand how these gaps were likely to change in the future (next five years) if current (generally around 2002) conditions prevailed. Seven professions were forecasted in each of the four Atlantic Provinces:

- Licensed practical nurses,
- Medical laboratory therapists,
- Medical radiation therapists,
- Occupational therapists,
- Physiotherapists,
- Registered nurses, and
- Social workers.

The regional roll-up of Phase I data suggested there will be an overall shortage in all seven of these professions. However, it is important to note that in some of the professions, certain provincial forecasts indicated a surplus is possible. The purpose of the Phase II work summarized in this report is to explore strategies for addressing the gaps identified in the Phase I studies.

The system dynamics simulation approach employed in the Phase II study was a logical "next step" in the HHR planning process being employed by the Atlantic Provinces. Simulation approaches are aimed at understanding the dynamics of factors affecting future HHR supplies and requirements. Simulation is conducted to understand how different components of the HHR system interact with each other over time, and to understand the relative impact of different policies including short-term versus long-term approaches to HHR policy interventions. In this way the simulations provide insight on how to adjust the system to address current and emerging problems.

The fifth deliverable involved a point-in-time roll-up of the results of each Atlantic Province's supply and demand analyses of major health occupations. The report for this deliverable was entitled *Atlantic Supply and Demand Roll-Up* (Kephart et al., 2004).

Data sources and recommendations regarding data harmonization issues, minimum data sets and data roll-up were examined for the following categories of variables:

<u>Population Health Needs and Service Requirements</u>

The team rolled-up data on population health status and changes in that status over time from survey data and vital statistics. We also rolled-up utilisation data by profession and sector. These data were needed for purposes of estimating current and future service requirements.

<u>Supply of Health care Providers</u>

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.

<u>Education/Training and Production of Health Human Resources</u>

Key variables rolled up as part of the study include attributes of training programmes (e.g., number of seats, years required to complete the programme, 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).

<u>Financial Variables</u>

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

<u>Management, Organization and Delivery of Services</u>

The information requirements identified under this category were addressed 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 included:

- The volume of services provided in each sector (e.g., acute care hospitals) 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.

Patient Outcomes

In this study, we incorporated 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) and morbidity. Such data were available from surveys and vital statistics.

Provider Outcomes

Consolidated payroll data in the provinces provided one source of data we considered as a means to assess provider outcomes. These data include information on worked versus earned hours, sick leave and disability. We examined 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.

Based on the structure of the modules in the simulation model developed (see below), and based on the availability of data, the team selected the following variables to be used in the simulation. The simulation model described in this report is applicable to any health care profession for which data on the these variables are available.

Module	**Variables**
Supply	Graduate entry rates, graduate age distribution, in-migration, provider stock, exit rates
Training	Seats, programme attrition, programme length, number of students, graduate out-migration
Work and Productivity	Productivity, worked hours, activity-adjusted providers available (computed)
Needs	Population, health status, level of service, service requirements, activity-adjusted providers required (computed)

Model Development

The sixth deliverable detailed the development of the simulation model, outlining the conceptual framework, the analytic framework, and the simulation tool itself. The functions of the simulation model were to do the following:

- Model supply of health providers currently in various sectors and those emerging from education/training programmes, provincially, regionally, and nationally in the future;
- Model the need for health education/training programmes as measured through population health data;
- Model the gap between the supply of and need for health care providers;
- Test various policy scenarios and conduct sensitivity analyses to compare the effectiveness of various policy scenarios in dealing with the gap; and
- Incorporate a variety of input variables, quantitative and qualitative, based on the environmental scan, research, and data availability.

The report for this deliverable was entitled *Health Human Resource Planning Simulation Model* (Kephart et al., 2004).

Traditional approaches to HHR planning have focused attention on the only number of providers, or in some cases the number of full-time equivalents (FTEs), to indicate supply. However, health care services are produced and delivered by a mix of different human and non-human resources (e.g., various technologies), and the non-human resources can influence the rate of service delivery by the human resources. Hence, a key determinant of the need for human resources will be the quantity (and type) of services produced per FTE provider (i.e., productivity). Because individual human resources do not produce health care services in isolation, provider productivity will depend on the availability of other health care inputs.

An underlying 'theme' of the traditional approaches 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 differs among planners, the 'indicator' or summary measure that forms the basis for thinking about the adequacy of supply is the provider-to-population ratio. The importance of the changing demographic structure of populations for the demand for health care is frequently acknowledged, yet this change is one of many factors to which the provider-to-population ratio is insensitive.

Further, the methods used for measuring demand are generally not independent of supply. In some cases, existing utilization by age and sex forms the basis of future forecasts of demand, but existing utilization is determined largely by existing supply. Seldom is consideration given to changes in needs and the implications for service requirements and, thus, human resource requirements. Hence, the HHR plans can be 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. Aggregate 'requirements' are taken to change solely 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.

If average needs per age group fall over time, there will be too many providers to simply meet needs at current service standards. Under systems 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 also increases.

In the present study, we have developed a simulation model on the basis of a conceptual framework and an analytical framework that accounts for both the population health status and the productivity of service providers. It is also designed to model the effects of varying levels of service.

Conceptual Framework

The methodology in the present study is derived from the conceptual framework (Figure 1) for HHR developed by O'Brien-Pallas et al. (2001). This framework has been adopted for use in HHR policy development by the Canadian Institute for Health Information (CIHI) and the World Health Organization (WHO).

The conceptual framework identifies the constructs that influence the requirements for HHR. It also identifies the pathways, both direct (independent) and indirect (interactions between influences), through which these influences operate.

There are a number of key features of the framework:

1. The need for health care services is based on scientific evidence that those services are effective in improving health status or preventing its deterioration at a population level.
2. Requirements for HHR are derived from the need for health care services that those human resources produce.
3. Health care services are produced from the use of a range of health care inputs that include both human and non-human resources.
4. The production of health care services and the use of HHR in the production of those services occur in prevailing social, cultural, economic and political contexts. These contexts are largely determined outside of the immediate remit of HHR policy makers and planners. However, the particular contexts will define the opportunities and constraints within which these policy makers and planners operate.
5. The capacity of training programmes is just one of many policy levers available to HHR policy makers aiming to respond to estimated gaps between future HHR requirements and supplies.

The framework provides the theoretical basis for a comparative analysis of existing HHR research as well as a conceptual foundation for the development of an analytical framework upon which simulations can be based and options generated.

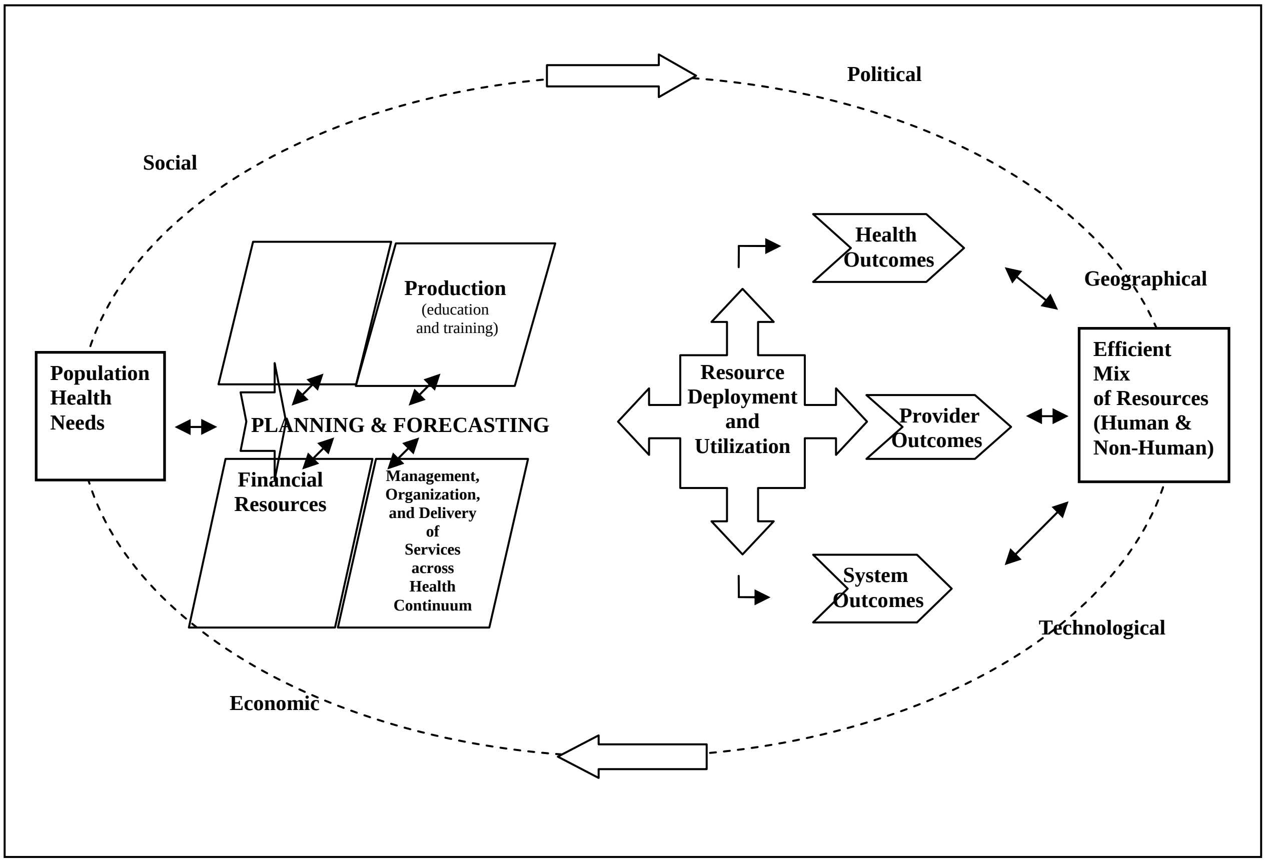


Figure 1: Health Human Resources Conceptual Framework

Analytical Framework

In order to inform the development of an empirical model to estimate HHR requirements and supplies, the influences identified in the conceptual framework are used to specify relationships between the ‘determinants’ of provider requirements and supplies in the form of an analytical framework. The analytical framework consists of two independent components: provider requirements and provider supply (a mathematical exposition of the analytical framework is presented in Appendix 2 of the final report (Birch et al., 2005).

Provider requirements can be seen as the ‘outcome’ of four broad determinants - the size and demographic mix of the population (demography), the levels of risks to health and morbidity in the population (epidemiology), the services deemed appropriate to address the levels of risks to health and morbidity (levels of service), and the rate of service delivery by providers (productivity). Because health care needs will differ by age and sex, the analytical framework is based on estimating the number of health care providers required to meet the health care needs of each age and sex group in the population. These estimated provider requirements are summed over all age and sex groups to estimate the total provider requirements.

Because different providers may have different levels of activity (e.g., part-time, full-time, overtime), HHR requirements are measured by activity-adjusted providers. The contribution of each determinant to the analytical framework is described below.

Demography: As the size and demographic mix of the population changes over time the number of providers required to meet the health care requirements of the population will also change, providing corresponding changes in services delivered.

Epidemiology: An important contribution of the needs-based approach introduced in the conceptual framework is the central role played by the needs of the population in 'driving' provider requirements. The levels and distribution of needs in the population are introduced explicitly as a determinant of provider requirements into the analytical framework.

Level of service: Introducing different levels of need explicitly into the analytical framework means that some method is required for translating need into requirements for services Although we might expect populations with lower levels of health status to be provided with greater quantities of services, the size of the 'health status-service provision' relationship is largely the result of provider discretion guided by professional guidelines and ethics and subject to the constraints imposed by prevailing budgets and models of care.

Because *level of service* is a determinant of provider requirements, changes in the level of service will affect requirements for providers.

Productivity: If policies are identified and implemented that increase provider productivity (i.e., services produced per hour of work) such as introducing technological advances, then the number of providers required to satisfy service requirements falls. Productivity depends on a variety of factors, including the intensity of work (i.e., proportion of worked hours given to patient care), how work is organized, technological inputs, and inputs of other types of professionals.

Contribution of the Analytical Framework:

Traditional approaches to estimating the required number of providers have largely been based on an implicit analytical framework based on just two elements – the demographic element, and a provider-to-population element. In this way the required number of providers is simply a weighted average of the size of different age-sex groups in the population irrespective of any changes in needs within population subgroups and changes in productivity among provider groups. If age- and sex-specific needs of the population fall over time (i.e., populations get healthier) and the productivity of health care providers increases over time, one might expect to observe substantial surpluses in the number of providers. However, because funding mechanisms for health care have tended to be dominated by service-based approaches, any surplus in providers may be matched by simultaneous, but often unplanned increases in the level of services per need.

In the present study no assumptions are made about the relationship between providers (or utilization) and population. Changes in epidemiology and changes in productivity are introduced as important determinants in the analytical model.

Provider requirements can be seen as the result of two empirical components - the *productivity component* and the *needs* *component*, with *needs* combining the three separate determinants of (1) levels of service, (2) epidemiology and (3) demography.

Supply can also be seen as the ‘outcome’ of two broad components - the *stock* of individuals, representing the number of providers in each age and sex group who are potentially available to provide health care services, and the *flow* of activities generated from the stock representing the quantity of output (e.g., time spent in the production of services). The flow of activities depends on: (1) the proportion of the current stock participating in the provision of health care (i.e., the participation rate), (2) the quantity of time devoted to service provision of those who do participate in the provision of health care (i.e., the activity rate), and (3) the quantity of services delivered by the providers per unit time (i.e., the productivity rate).

In addition to changes in the flow of activities, the size of the stock changes over time due to new entrants to the stock (inflows of providers from other regions and other countries together with new graduates within the region) and those leaving the stock (outflows of providers to other regions and other countries, retirements and deaths among providers).

Because education/training (the production of new providers) are generally separated from the management and regulation of providers (the use of existing providers) in terms of policy responsibilities, provider supply can be seen as the combination of two components, training and the supply of labour. This underscores the merit of this study’s regional collaboration between the Ministries of Health and Education in each of the Atlantic Provinces.

Simulation Model

Following both the conceptual and the analytical frameworks, we employed a system dynamics simulation approach (Song & Rathwell, 1994; O’Brien-Pallas, Baumann, Donner et al., 2001; Tomblin Murphy, 2002, Tomblin Murphy and O’Brien-Pallas, 2003; Richardson, 1991; Sterman, 2000; Wolstenholme, 1990; Forester, 1968; Kephart et al, 2005). System dynamics simulation differs from traditional estimations of HHR requirements (Ryten, 2002) aimed at generating estimates of future variables (Smith et al, 2001). Because the margin of error in estimates of future variables grows rapidly with the duration of the planning period the specific quantitative results are, at best, meaningful only within short time horizons.

In contrast, simulation approaches are aimed at understanding the dynamics of factors affecting future HHR supplies and requirements. Because the simulation model is designed to understand the dynamics of the system - specifically, how planning variables interact with each other in the short- and long-term - it adopts a much longer time horizon than that employed in traditional approaches to HHR planning.

The model is based on estimating and comparing provider supply with provider requirements. Provider supply is based on two modules (the training and the supply modules), as is provider requirements (productivity and needs modules).

Supply Module:

The foundation of the supply module is an estimate of the future size of the provider stock. This estimate is based on the following factors.

The current stock of providers: This includes all individuals with the appropriate license or registration for a particular health care profession irrespective of whether the individual is currently active in the delivery of health care services.

Entry to the stock: New entrants consist of new graduates of training programmes, and entrants to the region from other places. At the youngest ages, a large share of the entrants will generally come from training programmes, but at older ages, migration will usually be the primary source of entrances. Entry rates were estimated from registration data, where available. The graduate entry rate is the output of the training module (see below) and is expressed as the number of graduates per year. New graduates are allocated over ages 25 - 50 according to the "graduate age distribution". In-migration, also expressed in terms of number of entrants by age group per year, when combined with graduate entry, provides the overall entry to stock data.

Exit rates from the stock: Exits consist of deaths and retirements among providers, those moving to positions in other jurisdictions and those permanently leaving the profession for other occupations or to pursue other activities.[3] Because exit rates were estimated from registry data, and accurate data on reason for exit were not recorded in registry data, causes of exit are not explicitly identified in the simulation.

Together, the entry and exit rates determine whether the size of the stock at each age is growing or declining. Because the rates of entry and exit generally differ depending on age, the size and characteristics of the future stock is also a function of the *initial age distribution* of the stock. In the short-term, the age-distribution of a stock can exert a very powerful influence on its rate of growth or decline in size.

Training Module:

The training module focuses on estimating the flow of graduates into the provider stock. The number of 'seats' in a training programme is just one of several determinants of the flow of new graduates. In addition, the flow of graduates will depend on the length of the training programme (i.e., the distribution of years to graduation among cohorts of students), the attrition rate of the programme and the rate of entry to the regional provider stock of new graduates.

Other qualitative considerations may have important implications for the other elements of the model. For example, increasing the educational expectations of the training programme may involve selecting different types of students (e.g., a switch from diploma-level training to baccalaureate level). However, the higher quality of the entrant together with the increased level of training may increase the productivity of the graduate once in the stock of providers.

[3] By leaving the profession, we mean doing so permanently by allowing their certification to lapse. In our approach, providers who maintain their eligibility to work in the profession are treated as non-participating members of the stock of providers.

Work and Productivity Module:

The ability of the provider stock to meet provider requirements depends on both the numbers of providers and the hours of labour provided by the stock. Hence, the ‘work and productivity’ module translates the required number of services into the required number of providers given the levels of participation, activity and productivity of the providers.

Providers in the stock are characterized by different levels of participation and activity. Among those employed in service delivery (i.e., participants), the number of hours worked varies (e.g., part-time, full-time or more than full-time). Changes in the distribution of participation and activity of the provider stock provide important mechanisms for meeting provider requirements. Shifting workers from part-time to full-time status, or adding over-time shifts increases the number of FTEs employed in the system. However, such shifts may also negatively affect productivity (average rate of services delivered per hour of work) or the rate of exits from the system.

The ‘work and productivity’ module considers the average number of hours per provider (level of activity) and the average level of service delivery per hour worked by the provider (level of productivity) within provider groups. The overall level of activity will depend on the distribution of providers between part-time, full-time and overtime. Productivity is determined by several factors: the number of hours of work, the intensity of work (proportion of worked hours spent in direct patient care), and the availability of other resources.

Needs Module:

This module covers the needs for health care services by age and sex group of the population. Data for the *demographic determinant* were taken from Statistics Canada’s population estimates for the Atlantic Region. For the *epidemiology determinant*, the indicators of need used varied depending on the type of provider under consideration and were selected from three categories of ‘need’ constructs: measures of health risks, measures of morbidity, and measures of subjective health status. The constant distribution of need by age-sex group in the population over time is used as a baseline scenario and two alternative scenarios were considered regarding changes in the age- and sex-specific levels of needs over time. Thus, three needs scenarios were examined:

1. Population health needs remain unchanged;
2. They move to current levels observed for Canada as a whole over the next decade; and
3. They change in accordance with the observed trend in Atlantic Canada over the last decade.

The third determinant of the needs module is the *level of service.* Estimates of utilization by age, sex and health status of the population by sector (e.g., acute care, long-term care and community-based care) were used as baseline measures for this determinant. Data for the level of service, or utilization by level of need were not available in existing data sets. Hence, an approach was developed that combines data on the quantity and resource intensity of service use for the entire population of the Atlantic Region (e.g., the discharge abstract data (DAD)) with survey data on self-reported use by needs for a sample of the same Atlantic population (e.g., Canadian

Community Health Survey (CCHS)). In particular we assumed that the distribution of actual utilization data across need groups is the same as the distribution of self-reported utilization by need groups in health survey data. Thus, for example, we combined the Atlantic Region's self-reported population-based data on use of services by age and sex with the Atlantic Region's institutional level data on actual utilization by age and sex, calculated the ratio of actual utilization to self-reported use, and applied that ratio to self-reported use by level of need. The result is an estimate of actual utilization by level of need. In this way we convert changes in population size, distribution and health status to changes in service requirements.

It should be evident that the 'work and productivity' and the 'needs' modules are the mechanisms by which we implement two of the innovations of the simulation model; i.e., incorporating changes in provider productivity and changes in population health need into HHR planning. Together, these two modules also implement another innovation, the capacity of simulating the effects of changing levels of service on provider requirements. Clearly, if policy makers opt to change the level of service to the population, the provider requirements may also change.

Implementing the Simulation Model:

The simulation model was implemented using Vensim software (2002). Vensim allows planners to conceptualize, build, and run dynamic simulation models. Figure 2 describes the simulation model. This consists of:

- "Stock" (or "level") variables represented by double-line boxes (▭) (e.g., "Provider Stock"). These represent quantities that are modified over time by rate variables.
- Rate variables are represented by lines with "hourglasses" (⧖) (e.g., "Exit Rate"). These are "valves" that govern flows in and out of a stock.
- Input variables are denoted in regular text (e.g., "Seats," the total number of training seats that will be filled). They denote inputs into the simulation, and different scenarios can be implemented by changing the values of these variables. For example, scenarios can modify the number of seats.
- Computed variables denoted in **bold** are values computed as part of the simulation. For example, the "Gap" variable is computed as the difference in the number of activity-adjusted providers required and the estimated supply of such providers. The supply of activity-adjusted providers is computed from the number of providers in the stock and the distribution of hours worked.
- Scenarios to be considered are denoted by dashed boxes (⬚) and dashed arrows (◄┈┈).
- Flows of information denoted by solid lines with arrows (⟶) show which variables feed into the computation of other variables. For example, the required number of providers is computed from productivity and service requirements. Service requirements are in turn computed from data

inputs for health status, population demographics and levels of service.[4]

The simulation model draws on data sets contained in Excel spreadsheets. These spreadsheets contain all of the data required to run the model.

On completion of this study, both the simulation model and the spreadsheets were provided to HHR planning officers in each Atlantic province. These officers were trained in the use of the model and the spreadsheets. Ongoing support at Dalhousie University is available to these provinces.

The key merit of the above arrangement is that these provinces are able to update the data in the spreadsheets and re-run the analyses for each profession with sufficient data. Therefore, if assumptions used in this report need to be amended and/or new data become available, then the spreadsheets can be amended by the provinces and the analyses can be re-run.

Analytical Approach

The simulation analysis was composed of two separate steps:

General simulations: These were aimed at understanding the behaviour of the simulation model generally and identifying broad implications for the effects of particular modules in the context of the operation of the whole model.

The general simulations were based on analyses of each separate module of the simulation and included considering the effects of changing individual elements of the particular module on the estimated gap between provider requirements and supply. This included changing the size and age distribution of providers, rates of in-migration and rates of retirement among providers, the number of training seats, duration of training programmes, the out-migration of graduates of training programmes, the productivity of providers and the levels of activity of providers.

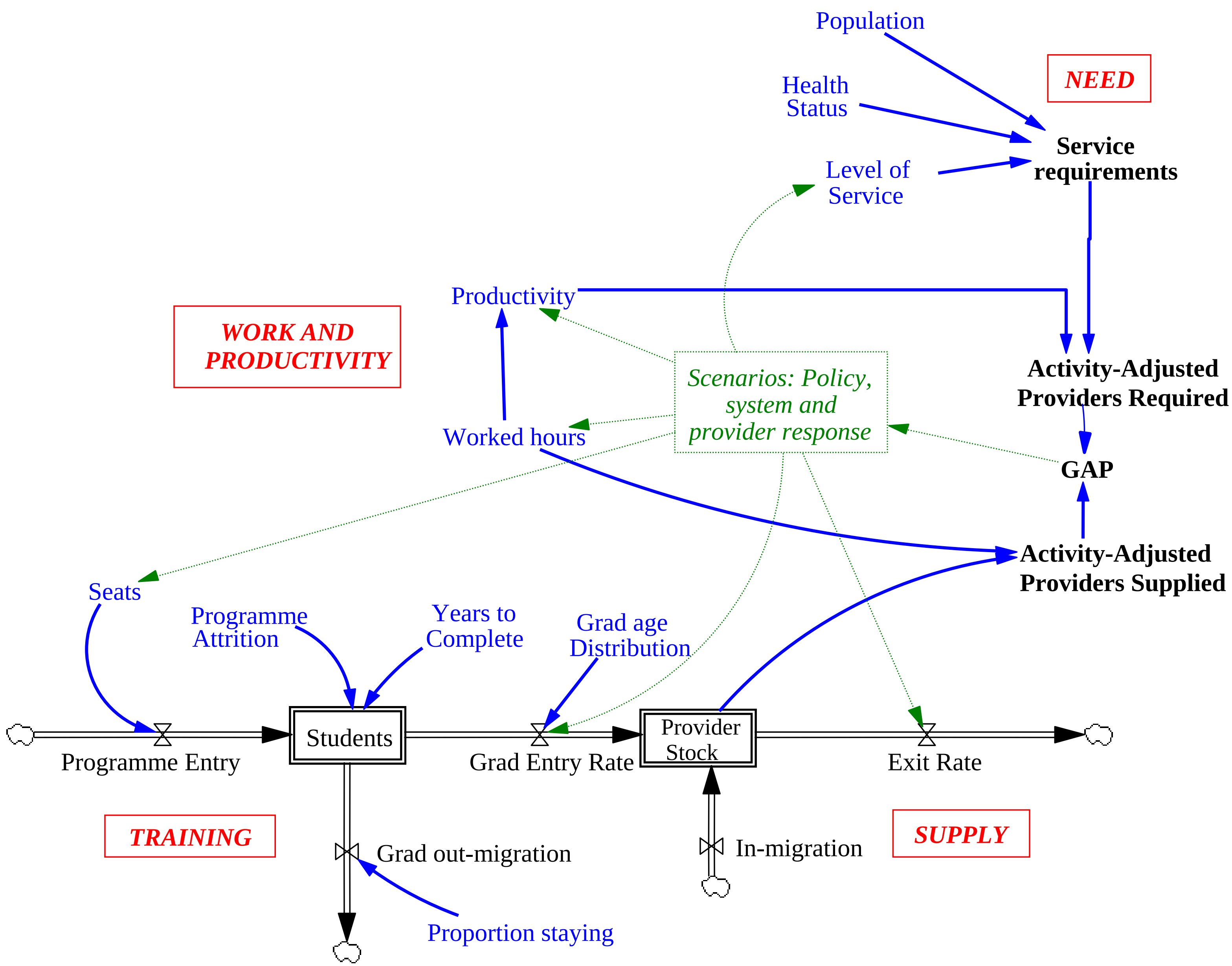
Profession-specific simulations: These were aimed at estimating the relative effectiveness of various policy scenarios in removing the anticipated gaps between provider requirements and supply over a 40 year period (i.e. a generation of providers).

For those professions projected to have a shortage in the first 15 years, we carried out two further analyses to determine the effect of various policies on the number of additional training seats required to remove the shortage. First we estimated the effect of separate policies on the change in seats required to remove the shortage. Second, we examined the cumulative effect of the policies by estimating the change in seats required to remove the shortage after adding each policy scenario sequentially.

Data to populate the simulation model were taken from a range of different sources including national population censuses, national population surveys (e.g., Canadian Community Health Survey (CCHS)), records of the health professions regulatory and professional bodies, the Canadian Institute for Health Information (CIHI) as well as the Ministries responsible for health care and higher education in the Atlantic Provinces.

[4] It should be noted that some elements of the diagram are incorporated into Excel spreadsheets rather than Vensim. For example, the service requirements variable is computed entirely through spreadsheets.

Figure 2: The Simulation Model



The professions simulated were only those for which required data were available. The availability of data differed among the four provinces as well as between health professions. Upon completion of the data roll-up it became clear that a number of the professions had insufficient data for simulation. While there was a great deal of data gleaned from the Phase I reports, CCHS and other surveys, as well as from the regulatory colleges and professional associations, as noted in Appendix 6 of the final report (Birch et al, 2005), there were substantial limitations in available data for many of the professions. Indeed, of the 30 professions examined, only 12 had sufficient data to run simulations. Descriptive information, largely a compilation of Phase I data from across all four Atlantic Provinces as well as profession-specific issues identified in the environmental scan, were provided in an appendix of the final report.

Simulations required careful consideration of each profession in order to 'customize' the application of the simulation model. For example, in the case of registered nurses (RNs), services are provided in very different settings (e.g., hospital, physician offices, community), while for family physician's (FPs) service delivery is much more homogeneous. Similarly, the content of the modules differed between professions and settings. For example, the indicator selected to represent population need was chosen to reflect the nature of the service provided by the professional group (e.g., prevalence of respiratory disease was used when simulating the respiratory therapists). Finally, the level of service variable was based on the current distribution of service levels by need group. In many cases service levels by need group had to be estimated from multiple data sources because utilization data were not available by need level.

We do not suggest that the current distributions of services by needs are optimal. Instead, current rates of utilization by need are used as a practical baseline for the purposes of considering planning scenarios. Moreover, as mentioned above, because of the modular nature of the simulation model, this can be changed to represent the impact of changing service levels by needs groups. If, for example, a funder (i.e., a government) decided to fund more frequent screening for any given condition, the level of service for that condition would be increased. The model is designed such that the impact of such a decision on the future provider gap can be simulated.

It is important to recognize that imbalances in HHR are the result of a range of influences, some of which are entirely outside of the control of individual provinces. In particular, HHR training is a responsibility of provincial governments; however, the graduates of provincial training programmes enter a pool of providers for which the different provincial and territorial administrations compete. As a result, an individual province can, for example, reduce the costs it incurs training HHR by employing those HHR trained in other provinces. In the absence of a Pan Canadian approach to the training *and employment* of HHR, the position of an individual province or region regarding the balance of HHR will depend crucially on the prevailing circumstances and HHR policies in other provinces/regions. This differs from other countries with publicly funded health care systems where HHR policy on training and employment is determined largely at the national level.

The focus of this report is the supply of and requirements for HHR in the Atlantic Region. However, the simulations presented are based on underlying assumptions that no changes occur within other provinces/regions with respect to HHR policies (e.g., recruitment initiatives). Hence the contents of this report should be read in this context.

The key objective of the profession-specific simulations is to test the relative effectiveness of various policy options in adjusting the gaps between those specific providers available and those required. With this key objective in mind, there are a number of important caveats that should guide the interpretation of the simulations. Although these caveats, in general, will not affect the overall conclusions drawn from the results, it is important that readers should recognize them and take them into consideration.

The first caveat is that this work is based on simulations, not forecasts. While the results show simulated gaps in future years, it would be wrong to interpret these results as forecasts. Future gaps are unlikely to follow simulated trajectories because model variables and health human resource policies will alter the future in ways that cannot be reliably anticipated. Changes in the following factors are likely to lead to deviations from simulated trajectories:

a. Entry and exit rates: Generally, the rates used in the simulations were average values based on the most recent empirical data available. However, for some professions, rates of entry and/or exit were highly variable over time in some provinces and age groups, making the future value of these rates difficult to predict. For example, trying to model the entries and exits of respiratory therapists over the age of 40 in Prince Edward Island is difficult because there are only about five of them. Small numbers introduce instability in estimated exit, and especially entry rates. Changes in entry and exit rates impact the gap trajectory (and therefore affect the future gap). However, these changes in rates will not change the overall effect of policy initiatives on future gaps (i.e. conclusions regarding policy options will remain fairly stable).

b. Future health needs: The models show the sensitivity of future gaps to changing needs. However, the needs scenarios that were modeled are not forecasts. Although there is some investigation in this area, it remains a challenge to anticipate the actual changes in need that may transpire in the future. It is known is that health needs have changed over time in the past (in some cases dramatically), and thus it is expected that health needs will continue to change in the future. However, currently the evidence base is not sufficiently detailed to determine what all the key indicators of health needs are, or precisely how health needs will change in the future. We chose indicators of need that, in our professional opinion, reflects the service requirements of the given profession modeled. While some indicators we employed have evidence in the literature to validate their use (e.g., self-assessed general health status has been correlated with measures of mortality and morbidity (Birch, 1995)), others do not. Because of this uncertainty about future health needs and their indicators, we have run each simulation under three different needs scenarios as a measure of the sensitivity of the gap analysis to changes in need. While changes in actual need trends from those modeled will alter the magnitude of the future gap, these changes in trends will not substantially alter the relative effects of different policy variables on the future gap (i.e. conclusions regarding policy options are fairly stable).

c. Level of service: Current patterns of utilization were generally used to define the level of service. Current utilization may not reflect the most appropriate level of service.

It is important that the most appropriate level of service by age, sex and health status be determined by evidence on effectiveness and efficiency (i.e., use types and frequencies of treatments that have been found to yield the greatest improvement in patient health without unduly taxing system resources). Also, as the simulated gaps presented for professions are highly sensitive to the level of service requirements incorporated into the models, changing models of service delivery will alter the level of service most appropriately provided by specific professions. Any change in level of service can be entered into the model to simulate its impact on the provider gap.

d. Feedback Processes: The model does not explicitly incorporate provider, system and health policy responses to changes in variables such as the distribution of worked hours and the gap between services available and services required (feedback processes). This is because there is insufficient evidence to permit formally incorporating feedback processes into the models at this stage. For example, providers may respond to shortages through higher work intensity in an effort to keep up with care requirements. There is evidence to suggest that this may reduce future productivity (i.e., working health care providers beyond a certain level of intensity leads to poorer patient and system outcomes) but it is not sufficiently detailed to dictate the mathematical relationship between work intensity and productivity. Because such feedback processes can also have large impacts on future human resource gaps, new policies should be informed and guided by any available relevant evidence on their potential consequences. These consequent effects should then be entered into the model to determine the impact on the provider gaps.

The reader is encouraged to take these qualifying comments under advisement while working though the results.

Results

The final report, of which this executive summary is a component, focuses on the seventh deliverable; i.e., populating the simulation planning model and providing recommendations for addressing shortages or surpluses in HHR. As mentioned earlier, this planning study was Phase II of a two phase regional cooperative. The intention was to build on the preliminary work done by each of the four Atlantic Provinces.

General Simulations

The general simulations highlighted a number of general principles that can help guide HHR planning:

- Ultimately, the size and age distribution of the provider stock is determined by age-specific rates of entry to and exit from the stock of providers (i.e., rates of recruitment and retention). Data on entry and exit rates are thus critical for HHR planning, and provides the basis for supply planning.
- Short-term supply problems in HHR planning result from large concentrations of providers in particular age groups, especially at the retirement ages. Avoiding “bulges” in the age distribution of the provider stock is thus an important planning objective. It is achieved by setting sensible recruitment and retention rates over time, and keeping them at stable levels.

- Short-term changes in HHR requirements are more effectively addressed by considering changes in the way the stock of providers is used as opposed to changes to the size of the stock. Because changes in entry and exit rates have on-going impacts on the size of the stock through their effects on the age distribution of the stock of providers, they are not particularly helpful or effective at dealing with short-term or time-limited changes in HHR requirements.

- Increasing or decreasing training seats is a long-term, not a short-term strategy for addressing provider gaps. Planners should consider increasing the number of training seats in situations where it is clear that the number of new entrants into the provider stock will not, *in the long run*, be sufficient to meet future service requirements. Increasing training seats to address short-term supply is unlikely to be effective.

- The impact of increasing training seats on supply, and thus on provider gaps, depends on the supply of labour that ultimately accrues from each additional training seat. This is determined by a variety of factors, including:

    - The percent of students who graduate;
    - The percent of graduates that enter the regional stock of providers;
    - The average number of years that graduates who enter the regional stock remain;
    - The percent of graduates who enter the stock who work;
    - The average number of hours worked by the working graduates; and
    - The productivity of working graduates (i.e., services provided per hour worked).

- Policies designed to change the level of activity and productivity of labour flowing from the provider stock offer the best short-term policy options for managing HHR gaps in the short-term. These include shifting workers from part-time to higher levels of work activity[5], and increasing worker productivity (services per hour worked).

- Future service requirements are sensitive to population health status as well as population demographics. Traditional HHR planning approaches only incorporate demographics.

- Using provider productivity data, future service requirements can be converted into future provider requirements. In this way the simulation model incorporates changes in population size, health need and level of service, and converts these changes into future provider requirements.

These general principles add to the existing body of knowledge of HHR planners. Application of these principles to profession-specific simulations further enhances the HHR planner's appreciation of them. This study reflects only initial

[5] This would include shifting providers from a low level of part-time activity to a higher level of part-time activity as well as shifting providers from part-time to full-time.

experience with a novel approach. As experience with this approach in the HHR planning community grows it is expected that the list of general principles will also grow.

Profession-Specific Simulations

The first set of simulations examined the effect of changes in model parameters, individually and in combination, on future provider gaps over the course of 40 years. The second set of simulations assesses the change in training seats that would be required to eliminate the projected provider shortage in 15 years under alternative policy scenarios. The profession-specific simulations were run for each of the three needs scenarios mentioned above in the methods section.

The different policy scenarios which were employed are as follows:

- Increasing productivity by 0.5% per year (cumulatively),
- Decreasing exit rates by 10%,
- Shifting 20% of part-time providers to full-time,
- Increasing in-migration by 10%,
- Decreasing graduate out-migration by 20%,
- Decreasing training programme attrition by 10%, and
- Increasing training seats by 20%.

These policy initiatives were all modeled individually and then cumulatively to understand their impact on the various provider gaps.

As has been mentioned , part of the purpose of the profession-specific simulations was to explore strategies for addressing the HHR provider gaps identified in the provinces' Phase I studies. However, some professions were not forecasted in one or more provinces. For those professions that had supply/demand forecasting completed in each of the four provinces, the simulation was initialized to the summed regional HHR gap across each of the provincial Phase I studies (for the year 2002). In professions for which Phase I forecasts were not available, the simulations were initialized with a gap of zero.

Table 1: Types of Simulations Conducted by Profession

Profession	Type of Simulation
Audiologists	Partial simulation – 'needs' module only
Family physicians (FPs)	Full simulation
Health records professionals (HRPs)	Partial simulation – 'needs' and 'work and productivity' modules only
Licensed practical nurses (LPNs)	Full simulation
Medical laboratory technologists (MLTs)	Full simulation
Medical radiation technologists (MRTs)	Partial simulation – 'training', 'supply', and 'work and productivity' only
Physiotherapists (PTs)	Partial Simulation – 'training' and 'supply' modules only
Radiation therapists (including dosimetrists)	Partial Simulation – 'needs' module only
Registered nurses (RNs)	Full Simulation
Respiratory therapists (RTs)	Full Simulation
Speech language pathologists (SLPs)	Partial Simulation – 'needs' module only

To implement the simulation tool for a specific profession, input data were required by province for the model inputs in each of the simulation modules. For all professions there were model variables for which high quality data were not available for one or more provinces. In such cases, assumed values had to be employed. Assumed values were most often based on the values of variables for another province for which data were available.

The specific purpose of the 15-year analyses was to illustrate the degree to which training seat requirements depend on other policy variables. The analyses should **not** be used to inform changes in the specific number of training seats, especially in those professions for which the starting gaps in the Region was unknown. As was shown in the general simulation, changing the number of training seats is a long-term strategy that does not have a substantial impact for 10 to 15 years, due to programme length and the fact that the new increments are small relative to the size of the existing provider stock. Moreover, planning training seats based on a time horizon of only 15 years can have negative longer term planning consequences. Both the short- and long-term effects must be kept in mind.

The simulations for the professions produced a variety of results. For some professions there was a projected surplus in the short-to-medium-term (less than 15 years), but a shortage in the long-term (beyond 15 years). Family physicians (FPs) and licensed practical nurses (LPNs) were such professions. For respiratory therapists (RTs) there was a projected shortage in the short-to-medium term but surpluses in the long-term. For registered nurses (RNs) and medical laboratory technologists (MLTs) there was a shortage in both the short- and long-term.

The profession-specific simulations demonstrated that different HHR strategies work most effectively for different professions, depending upon the attributes of the profession (e.g., its graduate out-migration rate, its age distribution, its proportion working part-time). For each profession it is apparent which policy scenarios (e.g., reducing graduate out-migration by 20%, increase productivity by 0.5%) are most effective in reducing the provider gap.

These analyses convey two main messages. The first is that the simulation model is applicable beyond nurses and physicians; it is applicable to any health profession for which sufficient data exists. The second is that the relative effectiveness (in terms of reducing provider gaps) of the various policy options available to HHR planners can be quantified for each profession. Indeed, the standard approach of changing the number of training seats is often among the least effective options.

Recommendations

Health human resource planning needs to be placed within the broader system in which health care services are provided, and it must take into account the impact of several important related factors. These factors are social, political, geographical, technological, and economic. It must also take into account how these influence the efficient and effective mix of both human and non-human resources. HHR planning cannot be performed effectively if it is performed in isolation of broader health care policy processes. We therefore urge the AHHRA to consider recommendations that promote and support models, practices and strategies for HHR planning which are needs-based, outcome directed, and which explicitly recognize and embrace the complex and dynamic nature of the factors that impact HHR planning decisions and allocations.

Moreover, building solid relationships and strengthening the links between both the research and policy communities will move HHR relevant research forward and enhance the use of findings in policy decision-making. There needs to be effective and ongoing coordination of the interaction among government, research and administrative stakeholders through advisory, research, and communication infrastructures. This coordination, together with an enhanced commitment to ongoing HHR research/policy infrastructure support, will help forge the links necessary to ensure optimal HHR planning for the future.

The Atlantic Provinces all employ different policies on such things as model of health delivery, recruitment and retention, seat allocations, length of education/training programmes, and to a certain extent credentialing and scopes of practice. While the simulation model developed in this project can be applied to each province individually, the overall results presented are regional. This suggests that, in order to be truly effective, the recommendations that follow must be carried out in a cooperative regional manner.

1. HHR policy should be developed based on the health needs of the population measured independently of utilization, supply, and demand.

2. It is critical that HHR policy development occur within the context of health services planning. The two questions to be answered in planning for HHR are: 'How many providers are (or will be) *available* to deliver health care services to the population?' and 'How many providers are (or will be) *required* to ensure sufficient delivery of health care services to meet the needs of the population?'

3. It is important that policy makers clearly identify the policy issues and objectives in advance of determining policy options. For example, if the critical issue is increasing access to primary health care, a new service delivery approach (e.g., interdisciplinary teams) may be more effective than increasing training seats.

4. HHR policy must consider the short-, medium-, and long-term impacts of potential policies to avoid implementing those that help in the short- and/or medium-term but give rise to additional problems in the long-term.

5. To avoid rapid decreases in supply, policies should be directed at smoothing out age distributions. Strategies to increase the numbers of providers in certain age groups need to be considered. For instance, providers in the 30-40 age range may require incentives targeted at the needs of providers in the child bearing years (e.g., child care or flexible schedules). Other age ranges may warrant strategies to increase the migration of professionals (e.g., salaries, education).

6. Policy makers should keep in mind that there are essentially two categories of policy options; one aimed at changing the number of providers (i.e., changing the stock), and the other aimed at making better use of the providers in the stock (improving flow of services).

7. Increasing the number of training seats should only be considered as a medium- to long-term strategy, and only when there is clearly an ongoing and consistent gap (i.e., evidence must be available to warrant increasing or decreasing training seats). It is important to first determine if the existing stock is optimized and, if so, still deemed to be inadequate. To ensure better returns on any investments in training seats, strategies to increase seats should be considered in conjunction with strategies to optimize the activity rates (worked hours per provider) and productivity (health care services per hour worked) of the existing stock. Further, policies directed at increasing or decreasing the number of seats should be introduced gradually, to avoid creating or exacerbating imbalances in the age distribution of health care providers.

8. Both reducing training programme attrition and increasing the retention of new graduates in the Region are quick and relatively cost-effective ways to increase supply. In the interests of efficiency, strategies aimed at both reducing attrition rates and increasing retention of graduates in the Region should be considered before any increases are made in training seats.

9. Changes to the lengths of training programmes should only be made after careful consideration of potential impacts of such changes on the flow of services.

10. Increasing in-migration of providers is an effective short-term option that produces an immediate increase in service flows. It may also be used to help correct any imbalances in the age distribution of a provider stock (in-migration of younger providers, for instance, could help to fill the distribution 'troughs' where there are not as many providers as in the mature age groups). However, these policies should only be implemented after careful consideration of their potential long-term impacts on the provider stock.

11. Policies aimed at increasing retention of the workforce (e.g., strategies aimed at enhancing working conditions, enhancing benefits, and the provisions and incentives for early retirement) need to consider the impacts of such policies on the age distribution of the provider stocks.

12. For provider groups with a "mature" age distribution, policies aimed solely at reducing retirement rates may be a short-term, stop-gap solution. However, in the long-term the "heaped" numbers of the providers lost may warrant an even larger increase in supply (which takes time). Accordingly, interventions to delay retirement should not be pursued in isolation from other interventions to address provider gaps. They are likely to be most useful as a strategy to "buy time" for other interventions.

13. Strategies to increase the flow of services: can be thought of under the following categories:

a. *Increasing participation rates* (proportion working): Examples may include policies that allow workers during childbearing years to remain in the workforce through the offering of on-site child care, part-time work, or to offer flexibility in scheduling.

b. *Increasing activity rates* (worked hours per provider): Strategies could be aimed at reducing absenteeism and providing full-time opportunities for part-time providers without adversely affecting their productivity (services per hour).

c. *Increasing productivity* (services per worked hour): HHR policy should take account of and plan for the changes in productivity of providers arising from changes in methods of service delivery, administrative support, collaborative team efforts, improved infrastructure and technological innovations in the provision of care.

14. A significant investment in data infrastructure to inform HHR planning and management in Atlantic Canada must be realized. Ongoing investment in accessible, comparable, and comprehensive data for HHR planning is critical.

15. To facilitate informed and effective planning, systematic data collection on the variables needed for the supply, training, work and productivity and needs modules should be collected regularly for health professions in the Atlantic Region. A good starting point would be to address the data gaps shown in Appendix 6 of the final report (Birch et al., 2005). For each profession simulated and for each province, Appendix 6 indicates the availability of data under each of the variables used in the simulation model.

16. The methodology for conducting projections for provider requirements based on needs of the population should be strengthened. Specifically, population health needs indicators must be identified and agreed upon, and the most robust yet practical projection methods determined.

17. Planning for HHR should not be done in silos (i.e., planning for nurses, planning for physicians, planning for medical laboratory technologists). For example, planners should simulate the impact of changes in one profession on the productivity of other collaborating professions.

18. A pan-Canadian HHR planning framework should be established. Such a framework would outline, on a national level, a forward thinking vision as well as the key goals, objectives and tangible actions/outcomes with a reasonable timeframe. Criteria and processes to manage, monitor, and evaluate such a HHR framework need to be established to ensure that it achieves its goals and adds value to jurisdictional planning efforts.

19. Atlantic Canada should consider the political feasibility and willingness to combine data at the regional level. Consolidation at the regional level would facilitate better regional planning. For example, a minimum data base based on the information items, indicators and data elements proposed in the CIHI (2005) National Minimum Data Set (NMDS) would facilitate HHR planning in Atlantic Canada. The establishment of a unique identifier for each health care provider would enhance the ability to plan for HHR (e.g., it can aid in tracking workforce imbalances and migration patterns). Furthermore, payroll data and registry data bases could be strengthened (both PEI and NB provide good examples of comprehensive data in this regard).

20. For HHR planning to be carried out effectively and to sustain a health workforce that has the skills and competencies to provide safe, high-quality care, partnerships between the policy community (both the Ministries of Education and Health), the education community, and the research community are essential. It is recommended that a Regional Standing Committee or Task Force to plan for HHR on a continuous basis be established. This mechanism could consist of a number of sub-groups mandated to deal with (for example): issues of education (e.g., the health ministry stakeholders discussing with the stakeholders of education ministries and educational institutions what is required from the graduates), regulatory requirements (e.g., provisions for in-migration of international health care providers), and planning (e.g., appraising the evidence and incorporating evidence in planning on a continuous basis). This Regional Standing Committee or Task Force would not come together to plan for HHR during a crisis. In contrast, it would be meeting continually and, hence, continually updating planning as new information becomes available and circumstances change/develop. The Committee/Task Force would also link into other aspects of health service planning (e.g., reciprocal representation). This mechanism would provide an opportunity for Atlantic Canada to provide leadership at both the national and international levels.

21. The Regional Standing Committee/Task Force should work to further flesh out and strategize on actions to achieve the goals and ideals set out in the recommendations of this report.

22. The federal government should invest in the Atlantic Region to facilitate the necessary partnerships and to enhance the infrastructure for regional HHR planning. This support will help to forge the links necessary to ensure optimal HHR planning for the future.

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