During the 1970s, nursing requirements forecasting received a lot of attention from governments and researchers, resulting in the development of many complex simulation models, as well as many estimates based on population ratios\(^1\). Few of these models are used today mainly because of the complexity and cost of maintaining the databases. Recent literature more often addresses specific factors influencing the supply or demand for nurses or prediction at the micro level.

**Population Based Projections**
- Manpower to population ratios were the dominant method of projection prior to 1970, resulting in basic, low, and high projections (e.g., DHEW, 1974b).
- Basic projections: assumes that factors affecting supply will follow current trends.
- Low projections: reflects a stabilizing of trends in level of training chosen by new entries.
- High projections: assumes that the ratio of nursing program entries to all college enrollments would remain the same.
- Many researchers adjust for attrition within specific age cohorts.
- Researchers generally assume that utilization patterns will remain stable.
- Ryten (1997) predicted a shortage of nurses by the year 2011 for all of Canada, using a cohort analysis modelled on demographic data, and gives three demand/employment scenarios, estimating a shortfall of between 59,000 and 113,000 nurses.

**Econometric Models**
Econometric models estimate the number of personnel required by the health system within the context of current and future resource constraints, including both met and unmet needs. For example, Deane and Yett (1979) estimated the effects of two major policy changes introduced in the 1960s and presented a complex model based on nurse market variables and on relatively simple determinations of demand. Their model performed well in predicting supply when compared to historical data from the same time period.

**Operations Research Models**
Operations research models are most commonly used in micro level studies to predict local staffing needs and efficient staff deployment. Sometimes this information can be aggregated to provide estimates of overall need across an industry. Assumptions are made about the stability of current behaviour and health care delivery patterns.

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Business Models
A new approach to nurse manpower forecasting is based on the business plans of health care organizations (HCO). The Nurse Workforce Modelling Tool (WMT), as an example of a business model, projects nursing workforce requirements in the U.S. based on current and anticipated utilization, payer categories, staffing patterns and utilization, capacity of staffing, and marketing plans (Shaikh, Silvers, & Prescott, unpublished). The WMT is described as follows:

- can be aggregated to produce regional forecasts, with versions available for acute care, long term care, and home care;
- inputs and outputs reflect impact of local and regional economics as interpreted by senior management;
- outputs reflect influence of local practice patterns and organizational culture;
- this method may support achievement of cost-effective staffing, given organizational characteristics;
- HCO administrators can use the WMT to model different scenarios and therefore can be used to generate future business plans that reflect planned changes in nurse staffing/utilization;
- inputting data manually at the HCO level may result in significant errors in key data therefore comparison with more widely used methods would seem advisable before more general use of this model is begun;
- it may not apply in less competitive health systems.

Theoretical Models (e.g., McTernan & Leiken, 1982)
McTernan and Leiken (1982) presented predictions of workforce patterns based on a theoretical framework that proved surprisingly accurate. They used a three stage model based on a basic pyramidal structure of the health workforce with few highly trained and paid workers at the apex and many minimally trained personnel at the base. This model:

- allows consideration of the interacting roles of government policy, health care requirements and the health labour force behaviour and;
- could prove a useful prediction tool for policy formation, but application to local planning situations is impractical due to the absence of quantitative data.

Simulation Models
Simulation is very flexible in that it can model the evolution of a real-world system over time based on mathematical or logical relations between objects and probability distributions. One iteration of a simulation generates one possible outcome; the model is run repeatedly to get an estimate of how the system will behave overall. They are often used to analyse “what if?” scenarios, a capability essential for use in health system planning. Though easy to apply and require fewer assumptions, simulation models can be costly to implement because of detailed data requirements.

References

References available upon request.


