NURSE DEPLOYMENT PATTERNS:
Examples for Health Human Resources Management

HMRU 90:1
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This report is one of a series describing the distribution of health human resources in British Columbia. These reports, prepared for the Health Manpower Working Group of the Ministry of Health, are working documents and comments or suggestions are welcome.
February 6, 1990

Ms. Vicki Farrally
Chairperson
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Dear Ms. Farrally:

It gives me great pleasure to submit to the Health Manpower Working Group this second report based on the Nurse Manpower Study, commissioned by the Deputy Minister of Health in 1987.

We believe this study provides a new analytic tool for the examination of issues pertaining to the management of nursing human resources, and should prove useful in the planning of future requirements.

As usual, we look forward to suggestions and comments from the members of the Health Manpower Working Group, as well as other readers of this report.

Yours sincerely,

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AK:da

Encl.
Acknowledgements

We wish to extend our appreciation to BCHA for providing the payroll data on which the analysis in this report is based.
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Introduction and Purpose

While the debate on the magnitude of current nurse shortages in hospitals - whether the province faces an absolute or relative shortage - is far from being resolved, it is clear that corrective measures are needed to first alleviate and eventually eliminate the problem. For the long-term, proactive measures need to be adopted to prevent the recurrence of the problem. For several reasons, these remedial measures are more likely to be successful if directed at changing conditions internal to each hospital. Implementing change on a small (i.e. at the agency level) scale is a lot more feasible than undertaking system-wide change. Furthermore, the organizational context is a key determinant in understanding labour force behaviour, and hence, should be the locus of action in addressing such problems. Finally, it is unlikely that, in the short term, the management of any single hospital (multi-hospital society) could sufficiently influence environmental conditions external to their institution in order to improve their current situation.

Hospitals have traditionally been predisposed, for various reasons, to deal with nursing shortages by emphasizing recruitment rather than retention of personnel. Similarly, studies describing nurse supply usually focus on points of entry to (and exit from) the "active pool" of employed nurses and often ignore the most important component of that pool; the cohort that remains in the workforce from one year to the next (Figure 1). High attrition and turnover rates have been considered unavoidable because nursing is a female-dominated profession and women's participation in the labour force is highly contingent on their family
Figure 1: Nurse Supply Model

Adapted from: Kazanjian et al. "Modelling the Supply of Nurse Labour", Medical Care, December 1986, 24(12)1067-1083
roles. However, the health care sector's past record of reliance upon immigration of nurses, in addition to incorporating modest increases in the number of nurses trained in-province (HMRU 88:7, 1988) has been inefficient at best, and certainly has proven to be ineffective during periods of fiscal restraint.

The purpose of this paper is to demonstrate that to invest in the "front end" of the management process is the best approach to this problem. Preventing human resource problems by optimizing regular staff deployment is more cost-effective than reacting repeatedly to shortages of qualified personnel through casual staffing. The thrust of the analysis is to examine and describe the staffing requirements of various patterns of nurse deployment and to develop a management model for maximizing current staff resources. In addition, this report provides information on ways to enhance the management of nursing resources through the systematic monitoring of personnel retention.

Literature Review

While the literature on human resources management is quite voluminous, it is appreciably more limited when it is concerned with the management of health human resources and even more contained when the area of interest is nursing human resources. It should be noted as well that U.S. studies in health human resources management are not often generalizable to the Canadian context, due to differences in health care
funding and organization between the respective systems. The literature review indicated two very distinct fields of research related to the study of nurse personnel management issues.

**Literature on Health Organizations**

The first was comprised of publications in the field of organizational theory and organizational behaviour which examine implications of those theories and behaviours for management in the health sector (Scott, 1981; Hage, 1980; Weber, 1964; Mooney, 1947; among others). This literature is based largely on the systematic investigation of different conceptions of how organizations work, and its purpose is to broaden theories of strategic planning and strategic management. The practical relevance of this literature to nurse human resources management was rather limited, in view of the numerous steps of inferential reasoning required to apply to nursing (one part of the complex healthcare sector) management theories pertaining to complex organizational structures.

One model of organizational behaviour described in this literature is the closed-system model which is based on the assumption that the most important features of organizations have to do with their internal structures and processes. Its opposite is the open-system model which is in turn based on the assumption that an organization's behaviour is best understood by taking into account its environment (Shortell and Kaluzny, 1988). Both models can be usefully applied to the current situation in B.C. (as elsewhere), to examine the reasons for fluctuating imbalances in nursing human resources. Unfortunately, no such effort exists. Our
review pointed to a serious gap in research concerned specifically with theories in the management of nursing resources; this is particularly alarming given the relatively large role this profession plays in the delivery of health care.

Literature on Nurse Shortages

A second approach for the study of nursing resources management was gleaned from the literature concerned with nurse shortages and its implications for staffing and scheduling of nursing departments. This literature is almost exclusively confined to nursing journals and, while it draws from other disciplinary perspectives such as economics and sociology, it is generally limited in theoretical breadth, but compensates by its depth of analysis. As might be expected, the volume of these publications is inversely proportional to market conditions. That is to say, there is less interest in studying nurse staffing issues during periods of relative surplus. Hence the previously mentioned proclivity for the consideration of recruitment problems rather than the examination of long-term measures for alleviating the situation, such as improved retention and innovative management of human resources.

Several studies from the second group are relevant to the situation in British Columbia, and describe rather simple management techniques that could result in the adoption of preventive measures. One such study purports to demonstrate how monitoring turnover indices using hospital administrative records might have predicted a critical shortage of staff and prevented bed closures in the study hospital (Mann and Jefferson,
An attitude survey of nurses and supervisors in this hospital complements the monitoring data and identifies critical components of the retention problem.

Using measurement indices adopted from another study (Duxburg and Armstrong, 1982), the study by Mann and Jefferson examines four turnover indices for the years 1982 to 1986 in a Medical Intensive Care Unit (MICU). The Instability Rate measured the percentage of staff at the beginning of the year who quit during the year; the Turnover Rate was a measure of the number of nurses who quit relative to the average number of nurses employed in the year; the Wastage Rate was the percentage of newly hired nurses who quit during their first year; and the Mean Service of Leavers was the average length of service among those who had quit. The data indicate that the rates for Instability and Turnover were similar while the Wastage rate was lower than both for 1982 to 1984, followed by sharp increases for all in 1985, signalling a severe degree of staff turbulence. These data, if collected, as part of routine monitoring of human resources, would provide accurate advance warning of potential problems. The survey results indicated significant agreement among respondents on reasons for quitting the MICU. Two-thirds (67%) of those who had left indicated that if they were given the opportunity to change work conditions, they would implement "adequate staffing" measures.

Another group of studies examines an alternative method of staffing which uses internal resource teams such as designated casual pools (Gale and Roark, 1985; Stenske et al, 1988). This method of staffing allows
flexibility of schedules and areas of practice, and provides financial incentives in the form of benefits or salary differentials for nurses' availability. While resource teams (RTs) are not a new concept in this province (Pacific Health Forum, 1987) they are by no means a widespread phenomenon. Nor has the idea been seriously evaluated as to its impact on nurse shortages. A recent U.S. study of a representative national sample identified the main characteristics of state-of-the-art RTs (Stenske et al, 1988). Among the 11 study recommendations directed to managers and pertaining to the use of RTs six are particularly relevant to British Columbia: provide multiple options for employment; designate a nurse manager for the RT, establish minimum work schedule requirements; allow flexible scheduling and a choice of shifts; and, design an individualized orientation program, with regular evaluation of RT members.

Another group of recent studies on nurse shortages advocates the employment of innovative methods of staff retention (Longo and Uranker, 1987; Marquis, 1988; Wall, 1988). The authors argue that proactive strategies for retention are not only desirable to ensure quality of care but also happen to be cost-effective. Furthermore, the need for a reliable database to monitor retention and its correlates is demonstrated and discussed in these studies. Without systematic evaluation of specific retention efforts, informed judgements about successful retention programs cannot be made nor can hospitals learn from each others' experience (Weisman, 1982).
Organization Design and Nurse Shortages

Finally, a few research publications make a direct association between organizational behaviour and nurse shortages. These studies are grounded in organizational theory and explore organizing principles and ensuing problems (McClure, 1982 and 1984; Kramer, 1988; Loveridge, 1988). McClure (1982) reported on a study designed to identify those hospitals throughout the U.S. that had reputations for being good places to work and had been successful in attracting and retaining professional nurses. In addition, certain criteria regarding retention and turnover rates, proportion of RNs on staff and ratio of nurses to patients also had to be met. Other work by the same author (McClure, 1984) relates modern management theory and practice to the field of nurse human resources management. Purpose, tasks, people, level of care and type of agency, technology, and structure are factors described as internal to the organization and to be fully understood by management, not only as independent factors but in concert with one another. External factors that must also be considered by managers include the economy, political pressures, legal aspects, sociocultural characteristics, and technology diffusion.

Until very recently hospital managers were mainly concerned with internal structures (closed-system model) and were not concerned about external factors (open-system model). While it is true that nurse managers may have little direct control of external factors, they should nevertheless be conscious that human resource management clearly affects and is affected by the environment. Contingency theory, which posits that
organizational structure is contingent on environmental factors, has helped some researchers in their understanding of the relationship between organizational structure and staff nurse retention. A study by Loveridge (1988) tests the tenets of contingency theory (Perrow, 1967) which suggest that a more bureaucratic, "mechanistic" form of organization is more effective when the environment is simple and stable, whereas a more "organic" form of organization is likely to be effective when the environment is complex and dynamic. Loveridge suggested that the combination of more flexible organizational structures with more complex technologic responsibilities is associated with a lower rate of staff nurse turnover.

A more recent analysis of organizational conditions which are conducive to improved retention (Kramer, 1988) undertook a comparison of 16 magnet hospitals with the 'best run' companies in a corporate community described in a 1982 study similar to the one on Magnet Hospitals (McClure, 1982). The findings concluded that the same characteristics are found in magnet hospitals and best run corporate communities. The analysis identified two perspectives of the nursing shortage - internal and external - of which internal shortages are created by conditions that exist in many hospitals (in varying degrees) for which the hospitals are more or less responsible, such as the use of large numbers of float or agency nurses and inadequate support to nurse manpower. External shortages are caused by insufficient numbers of trained personnel, increased need for nurse manpower due to higher technology, or population aging, etc., among others. In addition, internal nurse shortages create
and magnify external nurse shortages. What the magnet hospitals did was to create conditions that obviate internal nurse shortages. Consequently, if and when hit by an external shortage these hospitals are likely to feel it to a much lesser degree than those which have not created conditions which overcame the internal shortage.

Clearly, this literature review is neither extensive nor comprehensive. The major point to be made, however, is that there are lessons to be learned from the examination of organizational structures and environmental factors which circumscribe nurses' labour market behaviour.

Background to the Study

This study builds on our previous work included in The Nurse Manpower Study (Pulcins, Kazanjian, and Kerlue 1988). The earlier work was part of a three-volume study commissioned by the Deputy Minister of Health in 1987 and its purpose was to assess the current status of nurse manpower, as indicated by a synthesis of currently available data. The recommendations included in that report addressed the dual focus of the Deputy's study: the extent of manpower imbalances and the quality of the supporting evidence.

In brief, the 1988 study refined an earlier model for estimating registered nurse requirements (Kazanjian and Chan, 1984), by developing the methodology for expressing requirements in terms of total number of persons as opposed to the less specific measure of full-time-equivalents
(FTE's). More importantly, this 1988 study examined the effects of nurses' movement in the labour force and elaborated on the sensitivity of the health care system to fluctuations in both employment mix (that is, the mix of regular versus casual RNs), and deployment patterns (consisting of average annual hours of work).

Interesting results emerged from the development of hypothetical scenarios depicting changes in the composition of Regular and Casual staff as well as changes in the average hours of paid services by each group. This method of constructing scenarios can be used to test particular human resources management decisions or intervention strategies. The current study develops and further elaborates these management models.

Management of Nursing Resources

Many documented methods of evaluating the nursing shortage, quite appropriately tend to focus on "external" or system-based roots and exacerbating factors in an attempt to alleviate any current "crises". Yet our previous research (Nurse Advisory, 1988) has also pointed to the importance of a number of "internal" factors that are central to the relationship between nurse requirements in a particular facility (or municipality or region, for example) and the employment mix and personnel deployment patterns in that facility. Accordingly, the analysis presented here will explore the existence of different internal factors through a review of current personnel management practices in groups of facilities, and utilize this knowledge to maximize efficient deployment of existing personnel.
Whereas the number of nursing hours that will be required in a hospital or other medical facility is largely dependent on approved bed capacity and level and type of care offered, the size of nursing staff per se during the course of a year may fluctuate widely by type of facility as well as by employment profile of nursing staff. It is clearly recognized that the number of budgeted positions does not, in any event, translate clearly to the number of individuals needed to fill these positions. Depending on the mix of full-time, part-time and casual nursing staff (employment mix), the average number of paid hours for each of these three groups, and the level of stability of nursing workforce, the number of nurses required may be quite different according to facility type, size or other variable. Indeed, even the characteristics of the surrounding environs (e.g. a family-oriented suburb in contrast with the more transient inner-city) will to some extent determine the ratio of nursing hours to number of nurses required "on payroll" during a given period. Having identified these factors one develops the ability to evaluate more accurately the effect of such factors on the number of nurses that must be recruited every year. This knowledge may also be utilized to monitor their current effects, manipulate these parameters, and map out future strategies to effectively improve the utilization of existing nursing personnel and reduce the need for intensive, and expensive, recruiting campaigns.

The ability to understand and explain the mechanisms that are central to maximizing existing human resources in nursing, and moreover, to match the "right nurse" (i.e. with the appropriate level of clinical and/or
academic training) to the "right position", is particularly vital to today's seemingly tenuous nurse manpower situation. The combined effect of high turnover in many facilities, reported workplace dissatisfaction (Layton, 1988) and the resultant "dropping out" of the nursing profession for many, either on a permanent or temporary basis, has meant increasing difficulty in filling nursing vacancies (DTF, September 1989). These problems are compounded by intensified recruitment drives drawing on a relatively diminishing pool of potential supply, that is, increased personnel requirements relative to supply. For these reasons alone, it is necessary for managers to focus their attention on the efficient deployment of existing staff by implementing more flexible personnel policies. Whereas in most cases it would certainly not be desirable to decrease the number of budgeted Full-Time-Equivalents (FTE's) or total nursing hours to meet arising shortages, the need to reduce the number of individuals required to provide a given quantity of nursing care is highly desirable.

**Determinants of Efficient Personnel Deployment**

The primary determinants of efficient personnel deployment are presented schematically in Figure 2. Three sets of factors have been identified, each expressed as a bipolar continuum. The three-dimensional nature of this representation not only reinforces the need to separately assess each of the factors presented here, but more importantly, that their inter-relatedness be seriously considered in the planning of nursing resources.
The first component considered in this management model is workforce stability. Simply expressed, the size of the total nursing workforce required to fill a given number of nursing hours will be considerably smaller in a stable workplace environment than where recruitment for the same position or set of positions must occur repeatedly over a given period. Workforce stability may be considered on a variety of levels, and is typically undermined by either movement between hospitals (frequent lateral career movement in lieu of vertical movement, or perhaps simply a response to unfavourable workplace conditions), inter-regional migration, or movement out of nursing (into premature retirement or another choice of career). Where the level of attrition exceeds that which can normally be replaced by the flow of new graduates into the workforce, this type of movement may be labelled as "wastage".

The second dimension in the model may be defined as the existing employment mix, or the full-time employee ratio, as measured against the contingent of part-time and casual nursing staff. A relatively high proportion of full-time staff again reduces the number of nurses required on payroll to fill a given workload. Although when viewed as a purely arithmetic exercise, a full-time ratio approaching 1 would be considered optimal, it is recognized that a variety of tangible and intangible considerations require a different proportion of full-time staff from one facility to the next. In any event, the full-time ratio can have a quite significant impact upon recruitment efforts and therefore, upon unfilled demand.
The final component of the model, average paid hours, describes the mobilization of the paid workforce, and indirectly, the effect of unpaid leave and unpaid vacation days on personnel deployment. Our analyses show that this is most clearly manifested with casual staff, who collectively work an appreciably wider range of hours as compared to the more set hours required of full-time and part-time staff. But as evidenced here, even the average number of paid hours of full-time staff, or the proportion of an FTE worked by each, may fluctuate significantly between facility or regional groupings.

The "management cube" pictured in Figure 2 illustrates the interplay between these three dimensions. At one extreme, the "optimal" nurse deployment scenario is characterized by stability, or very little movement in or out of the workforce, a relatively high proportion of full-time staff members, and a high number of average hours by each staff classification. In contrast, the "pessimal" situation falls in a diametrically opposed position within this model. It is characterized by a high degree of movement within the workforce, a low full-time employee ratio and relatively low average number of paid hours per employee, thereby further increasing the number of nurses required to fill existing budgetary FTE requirements. Of course, the majority of the observed cases fall at some other point in this cube, and reflect the mix of "high" and "low" ratings on these three bipolar continua. It is precisely these cases that present the most interesting and relevant scenarios. The facility typified, for example, by even an extraordinarily high workforce stability will still require more nurses per FTE if their workforce is
compressed of a predominantly part-time, and especially casual staff, at the expense of a sizeable full-time pool. Or, consider the case of a facility boasting a large full-time contingent with a high average number of hours for all its staff, but which must continually undertake recruitment drives due to low workforce stability (high turnover) by its nursing staff.

When operationalized, this management model serves as an evaluative tool which may be applied at the facility, local or regional levels. Specifically, the dimensions featured within the model may be applied to the analysis of sensitivity of the system (i.e. a region or facility) to employment mix, patterns of nursing resource deployment and labour motility and wastage. In the following section, we apply this tool to the situation in British Columbia, and calculate indices measuring the relative status of several types of "peer group" hospitals on the three bipolar scales featured in the model.

**Data Development and Source**

The application of Figure 2 to the nurse manpower situation in British Columbia requires data which would adequately represent all hospital types in the province (in light of the requirements for the larger study within which this paper is couched) and be able to capture the degree of workforce stability (movement), the proportion of regular, full-time staff, and the average number of paid hours per nurse on payroll. Centralized payroll systems, such as the one provided by British Columbia Health Association (BCHA), contain such information and are
Figure 2: Schematic Representation of Factors Determining Efficient Personnel Deployment
essential to monitoring workforce behaviour and management practice. We have used the most recently available at the time of the study, the year ending December 1986.

The first step in the analysis of these data involved the examination of workforce characteristics. During the course of data preparation and development, however, it became clear that examples of individuals changing job status, terminating employment or temporarily dropping out of the nurse workforce during the period under study would not provide accurate and useful measures of nurse deployment because individuals could easily be double and triple counted, thus inflating the actual number of individuals involved. At the same time, it was recognized that these deviations from the "ideal" manpower scenario very clearly reflected the actual state of the nurse labour market in British Columbia. It was, therefore, very important to be able to accurately measure situations where there was frequent movement and contrast these to situation where movement was minimal.

Methods

Although there has been much discussion regarding the movement of nurses in and out of the workforce, this was to our knowledge represents a first attempt to quantify movement in a much broader sense.

The data indicated that in addition to changing employers, nurses were sometimes simultaneously employed by more than one hospital. All combinations of employment status were possible; for example, a nurse
could be employed full-time in one hospital and on call-in basis (casual) in another, or, have two part-time positions, etc. Conversely, a nurse could change employment status during the year while remaining with the same employer. Of course, the normal flow in and out of the workforce was also captured by these data. Thus, a nurse could have commenced or terminated employment during the course of the year and, therefore, was not fully productive that year.

In contrast, the data indicated that some nurses were employed at one hospital all year, and even if changes in status had occurred, there had been no discontinuities in employment.

We therefore developed a methodology which would best describe two facets of nurse resources management. Two scenarios were developed. The "static" or "ideal" scenario necessitated the exclusion of all records which were not continuous in the year. According to this formula, all cases which switched employment status, or either terminated or commenced employment during the course of the year were excluded from the sample.

The "dynamic" or "real" scenario was constructed in a different manner. In this case, if the number of hours for an individual nurse was split between employment statuses, they were proportionally distributed. Likewise, the appropriate fractions of individuals who were not continuous employees during the whole year were considered. Finally, if individual nurses had not been eliminated from the database at this point, and were found to be working in more than one hospital within the system studied,
the total number of hours split between hospitals was verified and the corresponding "proportion" of the individual was partitioned likewise. As a result, movement in the workforce is fully captured in this analysis.

Overall, the manner in which records are counted is the same for both scenarios; however, the record selection process between the two differs markedly. The final step in this phase of data development was an examination of the difference between the "static" and "dynamic" scenarios. The difference showed the degree of motility in any one setting and could be compared across settings. This measure provided us with an accurate index of workforce stability (Figure 2).

The indices measuring both average number of paid hours per status category and proportion of full-time nursing staff are self-evident and computationally simple. Total number of nursing personnel was used as the denominator for the latter, and total number of paid hours by status for the former. The data indicated that there were large variations in the proportionate distribution of Regular versus Casual components of the nurse workforce. It was noted that some employers tended to be heavier users of casual staff than others. Similarly, there were variations in the breakdown of Regular staff to its Full- and Part-time components. Closely related to this dimension, yet conceptually separate is the measurement of the average number of paid hours per nurse, within each employment status. While it is expected that appreciable variation will exist within the Casual component, the data indicated that some variation existed, by hospital, among Full-time staff. Thus, a full-time nurse is a
full-time nurse, is a full-time nurse, did not hold, the results demonstrated variability even within a single hospital.

For the analysis described here, these indices were calculated for nine different groupings of "peer hospitals", as well as the aggregate measures for the province of British Columbia as a whole. The hospital "peer groups" were identified on the basis of selected factors which were, on an a priori basis, deemed to be characteristic of major groups of facilities in the province. These include location (metropolitan, non-metropolitan, suburban, urban), function (e.g. teaching vs. non-teaching hospitals), size and bed type (extended vs. acute care). Clearly, these categories have some overlap, but that was not unintentional and did not in any way mislead the interpretation of the results.

The final product of this exercise is a set of three indices which measure the factors identified in the management model. These serve two functions. First, it is possible to evaluate the relative deployment performance of different groups of hospitals in the province. Secondly, one may then change the parameters according to hypothetical criteria, and estimate the impact of new personnel and/or managerial policies at the facility (or regional) level on the need for recruiting additional nursing resources.

In summary, the development of the management model (Figure 2) facilitates the understanding of how shortage situations may arise and may be addressed, at least in part, through the proactive management of
resources. The model also provides a succinct conceptualization of the three major dimensions contributing to the optimization of nurse human resources.

**Patterns of Nursing Resource Deployment in British Columbia**

The analysis of patterns of nursing resource deployment in any given facility or set of facilities calls for both the uni-dimensional that is, each dimension taken alone, as well as multi-dimensional (i.e. taken together) consideration of the three components of the management model presented here. In this section, we will evaluate the management of nursing resources through the examination of several like hospital groupings in British Columbia. Following this, scenarios will be constructed in order to demonstrate alternate management strategies designed to both plan and enhance current personnel deployment strategies.

In the first instance, employment status rates and average number of paid hours by status are displayed by peer-grouped hospitals in Table 1. The data show that in terms of the employment status ratio (Full-time:Part-time:Casual), the "urban" group displayed a markedly higher utilization of full-time staff at 0.791 (or 79%) vs. 0.599 for the low groups, and more restricted deployment of casual and especially part-time staff, therefore appearing to have a more efficient pattern of manpower deployment than other groupings. On the other hand, those hospitals with more than 40 percent extended care beds displayed a tendency to a high proportion of part time nursing staff at 0.232 (or 23%), and a correspondingly low proportion of full-time nursing staff.
### TABLE 1
PERSONNEL DEPLOYMENT INDICES IN SELECTED HOSPITALS IN BRITISH COLUMBIA

<table>
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<tr>
<th>Hospital Group</th>
<th>Employment Status Ratio</th>
<th>Average Hours</th>
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<tr>
<td></td>
<td>Full-Time</td>
<td>Part-Time</td>
</tr>
<tr>
<td>Metropolitan</td>
<td>0.681</td>
<td>0.168</td>
</tr>
<tr>
<td>Non-Metropolitan</td>
<td>0.640</td>
<td>0.183</td>
</tr>
<tr>
<td>GVRHD, &gt;500 Beds</td>
<td>0.667</td>
<td>0.178</td>
</tr>
<tr>
<td>GVRHD, &lt;500 Beds</td>
<td>0.603</td>
<td>0.213</td>
</tr>
<tr>
<td>GVRHD Non-Teaching</td>
<td>0.636</td>
<td>0.195</td>
</tr>
<tr>
<td>GVRHD Teaching</td>
<td>0.698</td>
<td>0.161</td>
</tr>
<tr>
<td>&gt;40% Extended Care Beds</td>
<td>0.599</td>
<td>0.232</td>
</tr>
<tr>
<td>Suburban</td>
<td>0.624</td>
<td>0.209</td>
</tr>
<tr>
<td>Urban</td>
<td>0.791</td>
<td>0.082</td>
</tr>
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</table>
While the patient population in extended care beds is more stable than in acute care, it should be noted that these facilities with more than 40 percent extended care beds were most likely to be located in suburban areas and, therefore, replicate closely the employment mix ratios of the latter. In contrast, however, the measure on average hours was quite different. The highest proportion of casual staff could be attributed to the smaller hospitals in the Greater Vancouver Regional Hospital District 0.184 (or 18%). Clearly, and perhaps somewhat surprisingly, the data show that there do, in fact, exist substantial fluctuations in these ratios between British Columbia hospitals. Furthermore, the results suggest that this may be an "internal" factor that maybe at least partially manipulated by personnel deployment strategy.

Since an all full-time complement may not be the most efficient way to staff a facility, nurse deployment patterns were examined in detail. The actual average number of paid hours per employment status revealed fluctuations similar to the previous factor. When measured in this manner, a somewhat different picture of "efficiency" regarding personnel deployment emerges from these data. In this case, the urban hospitals rated relatively low despite their large full-time contingent. Full-time staff worked the lowest number of hours (at 1,540) than any of the other peer-grouped hospitals, despite their commendable high ratio of full-time nurses compared to part-time or casual staff. At the same time, the same hospitals, which ranked high in proportion of casual staff (small
hospitals, GVRHD), obtained the highest number of average hours (at 1,709) from their full-time nursing staff.

To render these results more meaningful one must go one step further to combine these indices and view them on at least a two-dimensional plane. On the basis of these indices, it is possible to compare the efficiency of manpower deployment of peer-group hospitals using a standardized criterion. Here, results are standardized by calculating the total number of nurses required to provide 200,000 hours of undifferentiated nursing care. Although this model does not differentiate between nursing specialties or the different levels of care which may account for at least some of the observed differences between hospitals, it does nevertheless illustrate the possible effects of such variations between facilities. The figure of 200,000 hours was chosen specifically because it was a "reasonable" approximate figure for many of the facilities under study. It was representative of most regional hospitals and some of the larger community hospitals. In addition, nurse managers are often in this position when they are given a budgetary allocation but no other information with which to plan their human resource requirements.

The results of this evaluative exercise are presented in Table 2, which illustrates very clearly the variable number of nurses required to staff 200,000 hours, taking into consideration the "normal" movement in the workforce previously discussed for each of the groupings. The table shows that it would take a minimum of 158 and a maximum of 176 individual
### TABLE 2

**NURSES REQUIRED PER 200,000 NURSING HOURS IN SELECTED HOSPITAL GROUPS IN BRITISH COLUMBIA**

<table>
<thead>
<tr>
<th>Hospital Group</th>
<th>Full-time</th>
<th>Part-time</th>
<th>Casual</th>
<th>Total</th>
</tr>
</thead>
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<td>50</td>
<td>164</td>
</tr>
<tr>
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<td>166</td>
</tr>
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<td>50</td>
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<tr>
<td>&gt;40% Extended Care Beds</td>
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<td>174</td>
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<td>56</td>
<td>168</td>
</tr>
<tr>
<td>Urban</td>
<td>102</td>
<td>14</td>
<td>42</td>
<td>158</td>
</tr>
</tbody>
</table>
RNs to provide 200,000 hours of nursing services, given the observed employment status ratios and average hours of the respective groupings. The difference of 18 nurses constitutes 11 percent of the staff complement. The combined effect of both employment status ratio and average paid hours per nurse over a period of one year has been that the urban peer-grouped hospitals require the least number of nurses over the period of one year to fill the required number of nursing hours, mainly due to the large proportion of full-time staff. In contrast, small hospitals in GVRHD (< 500 beds) require the highest number of RN staff despite their top ranking in average hours worked by full-time staff. It should be noted that casual staff in this type of facility provide very low average hours and thus contribute to the inflation of the total figure. In non-metropolitan settings, while both the number of full-time staff and their average hours are similar to those of small hospitals, the difference in casual average hours results in a smaller staff complement.

But this still does not tell the whole story. Measuring a facility's deployment of nursing personnel against the third dimension of the model, workforce stability, may paint an entirely different picture than a two-dimensional analysis alone. This index is operationalized in a slightly different manner from the above two measures. In this case, a motility, or wastage factor is calculated for each employee type (full-time, part-time, casual) based on both observed paid hours for all staff and hours which are attributable only to those nurses who have been continuous employees throughout the year under analysis. In other words, they have not changed employers or dropped out of the workforce during the course of
the year under analysis. Specifically, this wastage factor measure is the proportional difference between the actual, total observed number of paid hours (which, of course, incorporates all individuals dropping into and out of the work force throughout the year) and the number of paid hours from which have been filtered out all hours paid to noncontinuous employees. This difference, then, represents the degree of wastage within the system because the labour market behaviour of the stable subgroup within each grouping represents the "gold standard" against which everyone can be measured. As the index nears 0 (a score of 0 is only a theoretical possibility), wastage and movement in the system are minimized. It is important to remember that this is not an absolute measure. Nor does it measure retention, or conversely, turnover, per se especially since this is a measure of movement in a limited time period (i.e. 12 months). Long-term retention may be inferred from this measure only if the period under study can be ascertained to be a typical 12-month period. Rather, this is a relative measure of the approximate proportion of paid hours by "stable" versus "instable" or discontinuous staff. Expressed as a percentage, this statistic is rendered meaningful when compared to that for other facilities or to a regional aggregate, for example.

The results from the peer-groups hospitals in British Columbia reveal interesting results (Table 3). Overall, the lowest wastage level was exhibited by those facilities with a high proportion of extended care beds (23%), non-metropolitan hospitals (22%), and hospitals with less than 500 beds and non-teaching hospitals in the Greater Vancouver Regional Hospital District (31%). The highest level of motility, or wastage, was seen to
<table>
<thead>
<tr>
<th>Hospital Group</th>
<th>Full-time</th>
<th>Part-time</th>
<th>Casual</th>
<th>Total</th>
</tr>
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<tr>
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<td>22.75</td>
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<td>GVRHD Teaching</td>
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<td>26.18</td>
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</tr>
<tr>
<td>&gt;40% Extended Care Beds</td>
<td>18.80</td>
<td>19.05</td>
<td>41.10</td>
<td>22.63</td>
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<td>Suburban</td>
<td>25.89</td>
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<td>43.78</td>
<td>25.89</td>
</tr>
<tr>
<td>Urban</td>
<td>31.79</td>
<td>28.71</td>
<td>42.99</td>
<td>31.79</td>
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</table>
occur in urban hospitals (32%), closely followed by teaching hospitals (31%) (in the GVRHD). This is perhaps reflective of either personnel policies that results in workforce instability, an urban setting housing a more transient population or a combination of these and other factors. Expectedly, wastage was much higher in the casual sector in all cases, while those for full-time and part-time nurses did not differ markedly within each facility grouping. This analysis demonstrates the greater sensitivity of the market in British Columbia to fluctuations in the supply of casual RNs than regular ones, since every position staffed by casuals will bring an appreciably greater number of individual nurses through the system than will regular positions.

In these examples we cannot say anything about management or personnel deployment practices of the hospital grouped the basis of arbitrarily selected characteristics. Rather, we look at similarities and differences in deployment patterns of hospitals with certain like characteristics, and since we do not know from these data what their management practices have in common, if anything, it is not possible to comment on whether one group advocated more astute human resource policies than any other. It is possible, however, for facilities to compare one’s own performance with that of other similar hospitals in one’s jurisdiction.

Nevertheless, through the construction of scenarios to test alternate managerial policies, one can utilize the measures presented here as an evaluative tool in a facility. The human resource implications of
altering the current distribution of full-time, part-time and casual staff may be investigated in depth and tested. In this sense, the effects of certain management decisions or simply expected changes in the composition of the workforce may be examined. It is obvious that increasing the number of full-time staff in lieu of casual staff, for example, would result in a decline in the number of persons needed to fill RN FTE requirements. The indices calculated by this method afford the additional advantage of estimating the exact magnitude of such changes.

The sensitivity of the system to patterns of personnel deployment may be examined in a similar fashion. By altering the average number of hours worked (which may alternatively be expressed as the proportion of an FTE filled) within the model, it should be possible to examine the effect of managerial decisions concerning scheduling and staffing on nurse requirements.

For example, the effects of such simple parameter changes are illustrated in Table 4. These data demonstrate the impact two different parameter changes can have on the total number of nurses required to fill 200,000 nursing hours over the period of one year. In the first scenario, the proportion of full-time staff is increased by 5 percent in relation to part-time and casual staff, whose proportions are accordingly decreased by 2.5 percent each. The second scenario tests the possible effects of aiming to increase the average number of paid hours per casual nurse by 10 percent. When these two strategies were combined (Scenario 3), reductions in the number of individual nurses required throughout the year under
### Table 4

**EFFECT OF PARAMETER CHANGES ON NURSES REQUIRED PER 200,000 NURSING HOURS IN SELECTED HOSPITAL GROUPS IN BRITISH COLUMBIA**

<table>
<thead>
<tr>
<th>Hospital Group</th>
<th>Observed Total</th>
<th>SCENARIO 1*</th>
<th>SCENARIO 2**</th>
<th>SCENARIO 3***</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F/T  P/T  Casual  Total</td>
<td>F/T  P/T  Casual  Total</td>
<td>F/T  P/T  Casual  Total</td>
<td>F/T  P/T  Casual  Total</td>
</tr>
<tr>
<td>Metropolitan</td>
<td>164  90  26  42  156</td>
<td>84  30  46  158</td>
<td>90  26  38  152</td>
<td></td>
</tr>
<tr>
<td>Non-Metropolitan</td>
<td>166  82  26  48  166</td>
<td>76  32  52  160</td>
<td>82  26  38  154</td>
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</tr>
<tr>
<td>GVRHD, &gt;500 Beds</td>
<td>164  90  26  42  156</td>
<td>84  32  46  160</td>
<td>90  26  38  156</td>
<td></td>
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<tr>
<td>GVRHD, &lt;500 Beds</td>
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</tr>
<tr>
<td>GVRHD, Non-Teaching</td>
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<td>80  34  50  164</td>
<td>86  30  44  160</td>
<td></td>
</tr>
<tr>
<td>GVRHD, Teaching</td>
<td>160  96  24  36  154</td>
<td>90  28  40  156</td>
<td>96  24  32  150</td>
<td></td>
</tr>
<tr>
<td>&gt;40% Extended Care Beds</td>
<td>174  80  36  52  168</td>
<td>74  40  56  168</td>
<td>80  36  48  162</td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>168  82  32  46  162</td>
<td>76  36  50  162</td>
<td>82  32  42  158</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>158  110 10  34  152</td>
<td>102 14  38  156</td>
<td>110 10  30  150</td>
<td></td>
</tr>
</tbody>
</table>

* Proportion of full-time nursing staff is increased 5%; part-time and casual proportions are decreased by 2.5% each.
** Average paid hours per casual nurse increased 10%.
*** Both of the above changes are incorporated into this scenario.
analysis ranged from 4.9 percent (eight fewer nurses to staff each 200,000 hours in each of the large GVRHD hospitals) to over 7 percent (12 fewer in metropolitan hospitals). All three scenarios imply that a heavy reliance on casual staffing as a stop-gap measure in response to local nursing shortages may not be the most appropriate solution, and may, in fact, increase exponentially the total requirement of nurses in any given facility.

These tools, which have been designed to assess current, and test potential, nurse resource deployment policies and approaches, and which may be used at the provincial, regional, facility, or even departmental levels, also demonstrate that there is significant variation between facility type and location in the efficiency with which existing nursing resources are utilized. Clearly, retention, or conversely, movement which results in wastage (of human and financial resources to recruit and orient new nursing staff) plays a major role in estimating future total nurse requirements, when measured in terms of individual nurses rather than hours or FTE's. Personnel management and staffing policies play an important role in determining the direction of deployment trends. A rough indication of the direction of change desirable in management policies may be gauged from conceptually mapping out an agency's current "position" on each dimension of the management model discussed in this paper.

Implications for Health Managers

Perhaps the most important aspect of the management model discussed here is the assessment, by each facility, of the three factors which have
been demonstrated to be central to nurse requirements and the interrelationships of the three factors unique to each facility. Referring again to Figure 2, although it may be necessary to analyze the three axes separately, that is only a starting point to the analysis of the three-dimensional cube, and more importantly, one's position within this cube.

Clearly, depending on factors such as hospital type and role, bed capacity, location, and as in the examples offered here, some facilities may exhibit efficient deployment practices in one, two, or all three of the dimensions. Frequently, seemingly contradictory results may occur, in that indicators of both "efficiency" and "inefficiency" may exist in the same facility. For example, as shown in Table 1, the "urban" group employ the highest proportion of full-time staff of any of the peer groups (thus exhibiting an "efficient" deployment of staff), yet their full-time nurses provide the lowest observed average number of hours. Furthermore, the data in Table 3 show that this group exhibited the highest level of personnel instability, and one that markedly surpassed the level of any other of the peer grouped hospitals under analysis. Thus at the same time, this group appeared to be the "most" effective in terms of employment status mix as well as the "least" effective.

This observation leads to two important conclusion made earlier. First, it should be quite obvious that a show of seeming ineffectiveness along any particular dimension, such as high turnover, need not mean that the facility, or group of facilities under question has dealt with nurse deployment in an inefficient manner. Furthermore, frequently any two
single dimensions may exhibit contrary trends, but do not necessarily
cancel each other out. As a matter of fact, even low ratings on one of
the dimensions, when teamed with more efficient practice on another may
simply be a condition of the characteristics unique to the facility or
perhaps are determined by the behaviours exhibited on the other
dimensions. For example, the high turnover exhibited by the urban group
could be attributed simple to the higher rates of transient populations
typically associated with urban neighbourhoods, or it may be linked in
some manner to either relatively low average hours for full-time staff
(that is, low average hours are due to high turnover), or even to the
rather high contingent of full-time staff (that is, the employer is less
likely to use casual staff and is perhaps more demanding of full-time
staff).

The temporal order of these interrelationships has not been explored
in any depth to date. However, it may be important to know whether, for
example, low average hours may simply be a manifestation of general
discontent and therefore also linked to higher turnover rates, or
conversely, whether instability may be causally associated to low average
hours of nursing service provided by full-time staff.

Secondly, it becomes very clear that it is essential to analyze the
efficiency of staff deployment practices in a multi-dimensional manner,
i.e. within the framework of all three axes of the management model.
Turning again to the example of the urban hospital group, the analysis of
the dimensions individually might lead one to quite different conclusions
about the overall efficiency of their deployment practices. Only by considering the intersection of these dimensions can a true picture emerge. This is illustrated in Table 4, the so-called "bottom line". In spite of higher turnover, and a lower average number of hours, or perhaps because of a relatively large full-time contingent, the lowest observed number of individuals to fill 200,000 nursing hours was for this group. The analysis of turnover or average hours alone would not have necessarily pointed to this fact.

Still, this does indicate that it is the size of the full-time contingent, per se, that should be the dominant consideration for all types and sizes of facility. This was the case in urban hospitals, but the specific proportion of full-time staff will most likely differ with the unique needs of individual hospitals. Very definitely, what is "optimal" for one facility may be quite simply an unrealistic target for another. Consider the case of a rehabilitation facility, which arranges its staffing around a large full-time component and which rarely requires either emergency (on call), or supplementary staff (due to short-term workload fluctuations) compared to a general hospital removed from a major centre which relies on a large casual pool to fill need when it arises in the absence of a large regular staff component, which is not needed under every-day circumstances.

A number of issues arise from this examination of nurse deployment patterns, one of which is that of recruitment versus retention. Although the exact extent of the effect of retention for each facility type and
size is not clearly delineated, one can safely assume that retention policies will generally have a positive impact on nurse requirements. Since recruitment is very taxing in terms of fiscal and human resources (constant recruiting may be a drain on the budget due to expensive recruitment trips and other such strategies, and on both budget and staff due to double staffing during orientation periods, person-hours required to complete recruitment drives, etc.) and indirectly, in terms of quality of care (through frequent orientation periods), the more cost-effective alternative to managing nursing resources must lie in the area of policies designed to enhance retention.

Traditional strategies which depend on in-migration and new graduates to fill nursing vacancies may sometimes not be able to adequately provide the personnel to fill the nursing hours that are budgeted and required. This is demonstrated as provincial figures indicate that increasingly, the number of new registrants who had graduated from a nursing program in British Columbia is becoming almost equal to those graduating outside of B.C. (1,246 to 1245 respectively, for a two-year period ending in June, 1987). This is due to a decrease in the number of out-of-province registrants and not to the appreciable increase of in-province registrants. Thus, heavy demands are already being placed on the out-of-province pool of new registrants. Even if this were not the case, the migration of nurses has tended to be a "coat-tail" phenomenon, responding to fluctuations in, for example, the forestry industry and the inter-provincial or international patterns in migration that are primarily caused by such economic waves.
Regardless of which efficiency dimension becomes the principal target of strategies designed to improve deployment of nurses, it cannot be evaluated or even identified without the proper monitoring of site-specific trends over a period of time. These results indicate that even retroactive monitoring of these patterns are useful and may point to deficiencies or strengths within a given employment situation, and if acted on quickly, can be used as a basis for the testing of future management strategies by substituting new parameters as required. While the focus here has been on short-term monitoring only, the need for long-term monitoring clearly exists. One must be cautioned not to rely on assumptions regarding a ten-year period based on one-year’s data (i.e. if retention was high in 1986 it cannot be assumed to continue at a high for the following five year period). At least one study discussed earlier (Mann and Jefferson, 1988) demonstrated that this is an unwise inference. Of course, ongoing monitoring is the most valuable indicator of effectiveness of specific personnel policy shifts, and will alert management regarding the need for change of strategy where necessary.

In addition, the impact of staffing and scheduling on total nurse requirements cannot be underestimated. Again, while much attention, so far, has been focused on reducing overall nursing hours (e.g. by bed closures) to deal with shortages, an absence of any thoughtful discussion on maximizing existing resources through optimal manpower deployment should be apparent. A decrease in the number of individuals required, and indirectly, a more stable and dedicated nursing pool, can not only be
theorized about but can be concretely evaluated through new staffing and scheduling policies for nurses.

Monitoring and evaluating current and past practices of nurse deployment in the hospital setting should be a vital and inseparable facet of staffing. The results discussed here show the value of taking an explicitly planned approach when addressing not only immediate personnel concerns, but also the more serious nurse shortage problem. Using actual deployment statistics that apply to specific hospitals, groups of hospitals or entire jurisdictions provides a more rational, and certainly more tailor-made approach to the management of nursing resources. This approach facilitates the design of strategies specific to each case and is conducive to early intervention. With baseline information which depicts the local (or general) situation, the construction of various hypothetical scenarios allows managers to test new staffing policies prior to implementation, and to assess their case-specific appropriateness and effectiveness. As no two hospitals, or facilities are exactly the same, it is not reasonable to expect that a single "management strategy" will successfully address staff deployment problems in all facilities at all times.

Research on nurse turnover (Weisman, 1982) indicates that the organizational context (that is, each hospital culture) provides the meaning of otherwise apparently similar working conditions. For example, if shifts are less negotiable in one hospital than another, rotating shifts will more likely cause some dissatisfaction in the first facility
than in the second. The key to the solution of each problem situation is
the manager's ability to understand the reason(s) for the problem, and to
achieve the appropriate mix of nursing resources: full-time as well as
casual, experienced as well as new graduate, specialist as well as
generalist. Innovative management strategies would ensure that the
existing and prospective supply of nurses adequately meet nursing service
requirements (Ginzberg et al, 1982).
REFERENCES


