

**NURSING RESOURCE MANAGEMENT -  
CURRENT PRACTICES AND ALTERNATIVES**

by

**CHAN WAI HAN, FLORENCE**

**陳惠嫻**

**HUI WENDY WAN YEE**

**許蘊怡**

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APPROVAL

Name: Kim Seung Chul

Degree: MSc, PhD

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SCKim

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## **1.2 Relevance**

The primary audience of the project is, of course, nurse. From the level of staff nurse, the relevancy of this study extends to the nursing management and finally to the hospital authority. Rostering is one of the many parts of nursing system, and also an indispensable issue while designing a good nursing system. The stakeholders who can benefit from a good rostering system include not only nurses, but also the management, patients, doctors, and the society. The management gains by better resource allocation, patients gain by good health care delivery, doctors gain more help from professional nurses, and the society gains by the overall improvement of health care system. A good rostering system contributes to staff morale, health care delivery quality, human resource planning and execution, as well as nursing professionalism. Specifically speaking, this study helps to find ways to accommodate a more nurse-friendly shifting schedule and reduce nurses' workload.

## **1.3 Scope of Study**

Given the time and resource limit, we intend to interview one public hospital for the investigation. According to a physician working in a public hospital, the organization structure and usual nursing practice model are more or less the same for most of the public hospitals. In fact, the Hospital Authority is responsible for managing all the 44 public hospitals in Hong Kong which follow the same structural tree. Therefore, the findings from this study on one particular public hospital may have important implication to the entire medical industry.

The Prince of Wales Hospital is selected as to the suggestion of our project supervisor. There are two major reasons. First of all, the Prince of Wales Hospital is a public hospital under the management of Hospital Authority. Its structure and management are similar to that of most public hospitals. Secondly, the Prince of Wales Hospital is the University Hospital of the Chinese University of Hong Kong. This connection facilitates us for arranging appointment for interviews.

In this study, the focus is the secondary medical care services provided by nurses within the hospital. We decide to omit quality aspects of surgical and medical operations of nursing service delivery since the investigation in these areas requires professional judgement and is beyond our ability. Secondary care refers to the more specialized and complex medical care which is usually provided in a hospital setting (refer to Appendix A for the classification of care services). According to the statistics of the Hospital Authority web page, the Hospital Authority provides over 90% of the secondary care services in Hong Kong while the private sector covers less than 10% of it (refer to Appendix B for detailed statistics).

In this study, the Obstetric Ward of Obstetric and Gynecology Department is interviewed under the arrangement of the General Manager (Nursing) of the Prince of Wales Hospital. The human resource aspect of nurse management is inspected. Special attention is paid to the rostering system due to work nature of nurses. Nurses have to be responsible for 24 hours patient care delivery. This implies hospital nurses have to work shift to provide seamless healthcare services.

## **2. BACKGROUND**

### **2.1 Healthcare System in Hong Kong**

All over the world, there has been more emphasis on the cost-effectiveness of healthcare delivery system. Care providers in the developed countries such as the United States, Canada, United Kingdom and other European countries are urged to restructure their services with limited resources. Our healthcare system in Hong Kong is no exception.

Until the end of 1980s, the Hong Kong Government had been historically the direct health care provider to the general public. In 1986, the Hong Kong Government commissioned management consultants firm to review the public hospital system. Subsequently the Provisional Hospital Authority (PHA) was established in 1988 with an aim to develop “the ways which optimize the use of the resources available, improve efficiency and the hospital environment, and which will attract, retain and motivate high quality staff” (Wong, 1998). Two years later, PHA became an independent statutory body, the (Hong Kong) Hospital Authority (HA), to manage all public hospitals in Hong Kong which are responsible for over 90% of the secondary medical care in Hong Kong.

Within a hospital setting, labor costs usually occupy the largest portion of the total expenditure. Nurses in turn are the largest part of the work force and it makes nursing a major focus in management cost control. Under the management of the HA, the line of responsibilities for nursing have been re-defined. Under the previous system, as shown in Figure 1, staff nurses, including Registered Nurse (RNs) and Student Nurses, were accountable to the Nursing Officer (NO) at the ward level; the

NOs were, in turn, accountable to the Senior Nursing Officer (SNO) at the departmental level, and the SNOs to the Chief Nursing Officer (CNO) at the hospital level.

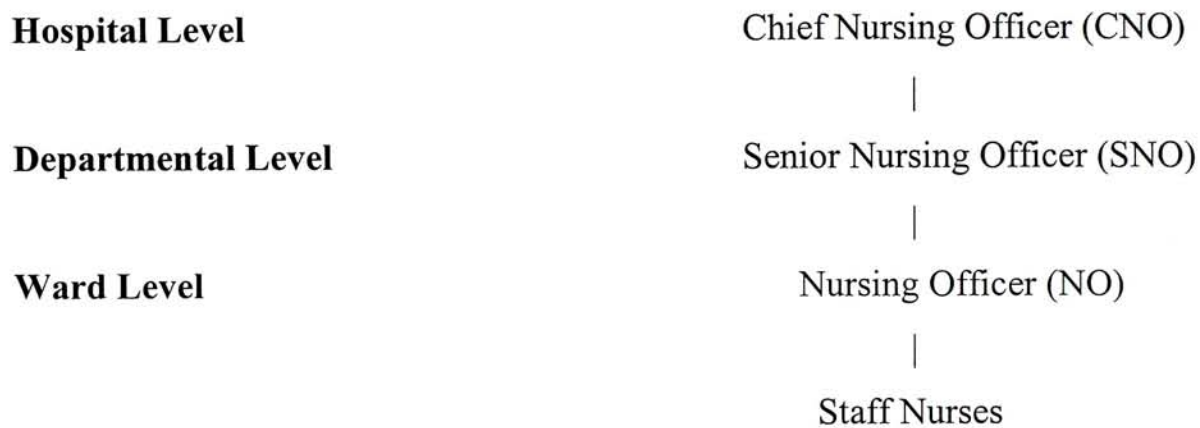


Figure 1. Line of responsibilities prior to the establishment of HA (Wong, 1998).

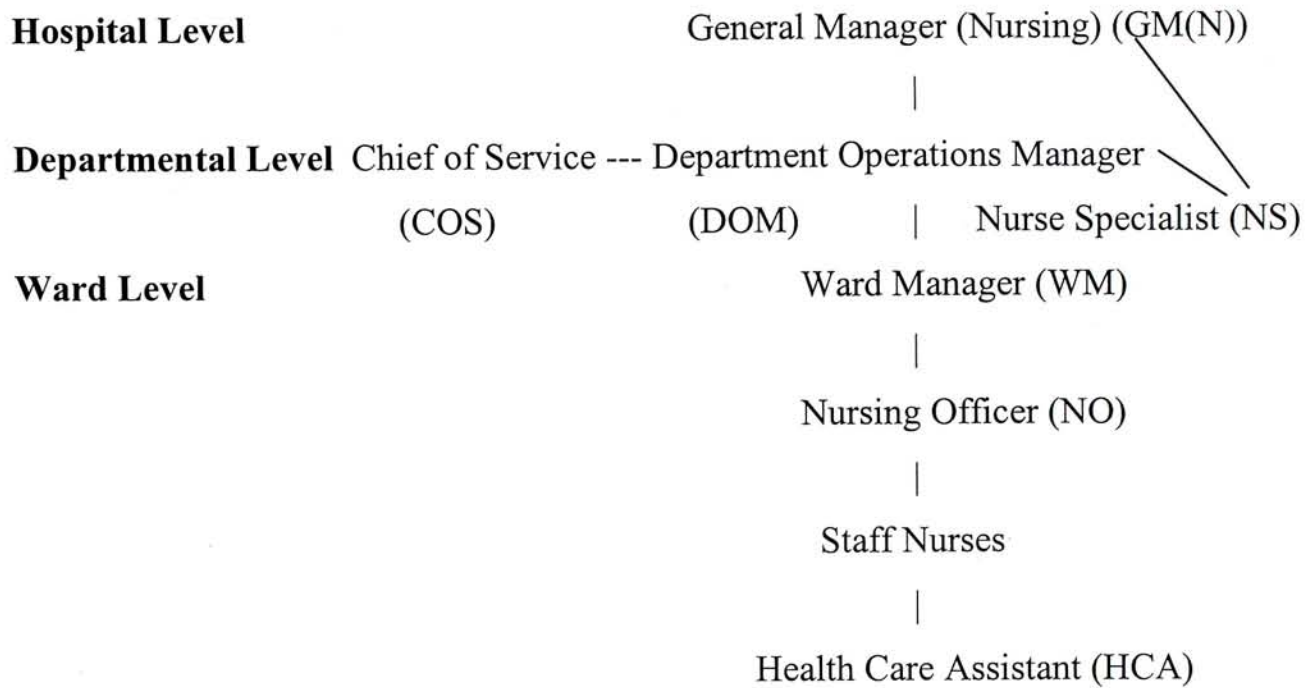


Figure 2. Line of responsibilities after the establishment of HA (Wong, 1998).

Under the present system, shown in Figure 2, each ward is looked after by a ward manager (WM). At the department level, the head, also the budget holder, is the Chief of Service (COS), who is a doctor. Working side by side with the COS is the Department Operations Manager (DOM). Both the WM and the DOM are nurse managers who take direct responsibility for all nursing activities in their units. The position of NO remains but NOs are now essentially regarded as “experienced nurses” who take the lead to provide direct patient care in the nursing team at ward level. The General Manager (Nursing) (GM(N)), assumes a consultant role to nurses in the hospital.

In the current system, there are two new positions, the Health Care Assistant (HCA) and the Nurse Specialist (NS). The HCAs help the qualified nurses to provide basic patient care such as feeding, taking vital signs, bathing, making beds,



transferring patients and cleaning equipment. Qualified nurses, on the other hand, undertake more complex technical tasks such as giving intravenous drugs, planning care, and monitoring and evaluating the effects of care.

The NSs are not under the ward/department management structure. Instead, they are directly accountable to the GM(N) or the DOMs of related specialty care, depending on the arrangement of the hospital. They do not provide routine care, and only attend to patients who require their expert nursing service. NSs are also responsible for quality improvement, staff development and research. Table 1 shows the work distribution of different levels of nurses.

	RN	NO	WM	DOM	NS
	(%)	(%)	(%)	(%)	(%)
Patient care	63.2	42.5	12.5	0	62
Student supervision	17.9	5.5	1.7	0	0
Staff development	5.0	16.5	12.5	9.0	12
Ward-in-charge	10.0	15.8	0	0	0
Quality improvement	3.9	10.0	10.0	41.0	12.2
Resource management	0	9.7	51.6	38.0	0
Research	0	0	0	0	13.8
Meeting and liason	0	0	11.7	12.0	0
Total	100	100	100	100	100

Table 1. Work distribution of different levels of nurses (Wong, 1998).

Beside changes in the line of responsibilities, there are also changes in the policy for resources allocation. Before the healthcare reform, there is one budget for labor expenses of all departments within a hospital. Now, each department is allocated a certain amount and it is the department's responsibility to efficiently plan for its expenditures. Therefore, nurses now have to think in terms of productivity and value of care, relating their work effort to financial return.

One indirect result of these changes in resource allocation policy is the increase in the pace of the already existing trend of "specialization" in nursing. Since the departments no longer share the same budget, it is now impossible to assign nurses from other departments to help out the department that is experiencing a peak period. With specialization, therefore, the hospital surrenders the mobility of nurses between departments, and hence, a certain level of flexibility in managing the nursing resource is also lost. However, specialization also means that nurses are allowed to gain more knowledge in dealing with patients in their own department. This knowledge gives them the ability to handle frequently occurring cases without seeking help from the doctor. In other words, specialization helps lessen the workload of the medical staff.

The healthcare reform in Hong Kong has, in general, elevated the professional status of nurses higher, especially with the introduction of the NS position; the NSs are required to do research and sometimes publish their works in academic journals. However, today, the hospital activities are still very much medically-centered. The doctors generate the work and the nurses would work under the medical orders. The fact that COS is the budget-holder of a department speaks for itself the reality of hospital situation.

### **3. RESEARCH DESIGN AND METHODOLOGY**

In view of the prevalent problem of shortage of nurses in the public hospitals in Hong Kong, the aim of this study is to identify possible alternatives to better manage nurses as a resource. The research involves a series of interviews with nurses of different ranks, observations of the nursing hand-over process, as well as review of the literature. The study looks into three aspects of nursing resource management, namely, 1) shiftwork, 2) computerization of shift rostering, and 3) alternative source of nursing resource. In each area, the study is divided into 3 phases.

**PHASE I:** Obtain understanding of the current common nursing management practices in Hong Kong, in particular, the planning and design of the schedules for nurses. The study methods used in this phase include unstructured interviews, and the observations of the hand-over process. Interviews were carried out with a DOM, WM and NO.

**PHASE II:** Explore alternatives with reference to overseas nursing management practices. The study method used in this phase involves a comprehensive review of the literature published in recent years.

**PHASE III:** Obtain professional opinion on the feasibility of the alternatives identified through an unstructured interview with the WM.

## 4. SHIFTWORK

### 4.1 Phase I: Current Situation

Shiftwork is an essential part of nursing, in which care is delivered over 24-hour periods. Staff nurses at ward level, including NOs, RMs, and student nurses have the work shifts. Currently in Hong Kong, there are two most common shift systems as shown in Table 2.

	Working hours	No. of hours		Working Hours	No. of hours
Night	11:00 pm – 7:00 am	8	Night	9:15 pm – 7:15 am	10
AM	7:00 am – 3:00 pm	8	AM	7:00am – 2:00 pm	7
PM	3:00 – 11:00 pm	8	PM	2:00 – 9:30 pm	7½

Table 2A. 3 × 8 shift system.

Table 2B. 7 - 7½ - 10 shift system<sup>1</sup>.

From a management's perspective, the 3 × 8 shift system is more convenient in planning because of the equal distribution of work hours among the different shifts. However, there are two distinct advantages of the 7 - 7½ - 10 shift system over the 3 × 8 shift system.

For example, in the 3 × 8 shift system, if a nurse has a PM shift, she leaves the hospital at 11:00 pm. When she gets home, it is probably already mid-night. If she has an AM shift the next day which requires her to get to the hospital by 7:00 am, the

<sup>1</sup> This missing of an overlap between the AM and PM shifts does not mean that there is no intershift hand-over. The nurses in the AM shift who need to hand over the job to the oncoming nurses will have to stay behind during the hand-over period which normally takes 15 minutes. To compensate for this, the nurse is allowed to take a longer break in her/his AM shift.

nurse will not have enough rest for the day. Furthermore, getting back home at late hours raises safety concerns to those who live in areas with high crime rate.

On the other hand, the 7 - 7½ - 10 shift system allows nurses of PM shifts to go home at 9:30 pm, which belongs to a much safer period. They get home earlier and will have adequate sleep even if she/he has an AM shift the next day. As a result, the 7 - 7½ - 10 shift system is more popular among the nurses. The only drawback is that it is slightly more difficult to manage and design fair schedules for each nurse due to the different number of hours for each shift.

Currently, the WM assumes the job of shift rostering with the assistance of the NO. The job is done manually on a chart and an example of the chart is shown in Appendix C. First, night shifts are assigned on a monthly basis. There are some general guidelines in assigning night shifts. For example, each person should only have one night shift per week, and in each night period, there must be certain number of nurses of certain level of experience in the ward. As an example, Table 3 shows the number of staff needed for different shift periods for the Obstetrics Ward of the Prince of Wales Hospital of the time of this study. After the night shifts have been assigned, the assignment chart will be posted and nurses can mark on it their own requests, if any. However, the number of requests is usually not many.

	Night	AM	PM
NO	1	2	2
RNM <sup>2</sup>	6	14	13

Table 3. Staff needs during different shift periods.

Taking into consideration of the nurses' requests, the weekly duty list (for an example, refer to Appendix D) is produced and posted. There are again some guidelines in producing the weekly schedule. For example, for every 5 nights, nurses are entitled to 2 Compensatory Off (CO) days; certain patterns such as PM-Off-AM, AM-Night-AM, etc. should be avoided taking into consideration of the health and social life of the nurses. Once the weekly duty list is posted, there is still room for changes. Nurses can swap their shifts with other nurses with the permission of the WM. One condition is that nurses can only swap shifts with nurses having comparable number of years of experience.

The amount of time used in rostering shifts is apparently not much and it seems to work fine. The use of computer is minimal and is mainly for preparing statistics and better presentation of the information.

The traditional hand-over and bedside hand-over are the two most common hand-over mechanisms in the public hospitals in Hong Kong. Traditional hand-over involves handing over of the information of all patients in the ward office. The information includes name, age, diagnosis, resuscitation status and any other

important information. Under bedside hand-over, the incoming nurse shares at the bedside with the patient and the person who has been accountable for the care.

In the O&G Department of the Prince of Wales Hospital, for example, at the end of a shift, one nurse in a ward is responsible for handing over her/his responsibilities at the bedside of approximately 5 patients who have been under her/his care to two incoming nurses. The process takes about 15 minutes. For most other oncoming nurses, they are required to gather at a ward office and listen to an NO's hand-over in the traditional approach. Beside medical information of patients, the information conveyed includes the announcement of new nursing policies, upcoming activities, new equipment and so on. It is a common scene that nurses drift in the hand-over because a lot of the information conveyed is irrelevant to their job.

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<sup>2</sup> RNM stands for Registered Nurse Midwife. After one year of training in Midwifery, a Registered Nurse becomes a Registered Nurse Midwife. This class of nurses is only found in the O&G Department.

## 4.2 Phase II: Exploring Other Possibilities

### 4.2.1 Shift Hours

The system of 12-, or more accurately, including the hand-over period, 12½-hour shifts has been raised as a potential way of achieving greater economic use of the nursing resource. An example of such shift system is shown in Table 4.

	Working hours	No. of hours
Day	7:45 am – 8:15 pm	12½
Night	7:45 pm – 8:15 am	12½

Table 4. 12½- hour shift system

It has been found in a study in the UK (Northcott and Facey, 1995) that, on the whole, nurses are quite happy with the arrangement. They know exactly what shift they would be working on any day in the future. They know exactly who would be on duty with them. The 12½- hour shift system also avoids the possibility of some nurses going home late at night. Another staff-friendly feature of 12½- hour shifts is that nurses' expenditure and time spent on travel is reduced, as the number of shifts worked, say, per month, are significantly less.

Continuity within the hospital should be more efficient with only two hand-over periods each day, and the continuity of care significantly improved for patients on short-stay admission. The argument is that 12½ shifts allow for each patient to be cared for by only two nurses in 24 hours and potentially over their entire stay by the



same two nurses. Given that the same nurses give all the care, it mitigates well for the “named nurse” concept<sup>3</sup>.

However, for long-stay patients, the 12½- hour shift system means no improvement in the continuity of care. Under this intensive shift system, after several consecutive days of work, nurses likewise need several days of break. Therefore, it is likely that a nurse, having spent time building a relationship with a long-stay patient, may not see the patient for several days during her/his break. Also it may be possible that by the time to come back to the hospital for work, the patient has already gone.

Some nurses working under the 12½- hour shift system also express concern with the end-of-shift tiredness. They find that they are less efficient towards the end of the shift and are afraid that they may be prone to error, especially when dealing with drugs (Facey, 1995). Furthermore, the accumulative effect of three or more 12½-hour shifts may not only jeopardize the standard of care but also place at risk the registration of the nurse.

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<sup>3</sup> The named nurse system is a common practice in the public hospitals in Hong Kong. The idea is to have a team of nurses responsible for all kinds of care of patients in one particular cubicle. Under the named nurse system, it is possible for nurses to develop personal relationships and hence better quality of care to patients in the cubicle.

#### 4.2.2 *Shift Rostering*

It is believed by most that working shifts can cause problems including fatigue, disturbed sleep, disruptions to social and domestic life and so on. However, research has shown that some roster systems of shifts appear to be more problematic than others. There are three main classes of roster systems: 1) Regular, 2) Irregular, 3) Flexible, and each definition is shown in Table 5.

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Regular	This is a fixed roster which is repeated when the cycle of shifts finishes, even if occasional variations occur to meet special requests.
Irregular	This is where the duty roster does not cycle or repeat in any regular manner and individual preferences are not taken into account.
Flexible	This means the individuals concerned are consulted about their preferred duty hours before the duty roster is drawn up.

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Table 5. Different roster system (Barton, 1995).

It was found in a study (Barton, 1995) that rotating shift nurses working in irregular systems result in poorer psychological health, more chronic fatigue, more social and domestic disruption, more disrupted sleep and more job dissatisfaction than those nurses working on flexible systems.

One reason for such a phenomenon is that taking individual preferences into consideration helps minimize the conflict often experienced between home life (as well as school life for those pursuing further education) and non-standard work hours. Furthermore, those who like to sleep late (the “owls”) tend to roster themselves for evening duty while those who rise early (the “larks”) roster themselves for morning

shifts (Keene, 1986). And it seems that if individual nurses are able to exert some control over which shifts they work, there is higher level of commitment to their work.

#### 4.3.3 *Intershift Hand-Overs*

Hand-Over is a universal phenomenon that comes along with shiftwork. Traditionally, the hand-over procedure involves either one or two people verbally relaying “all” information to the nurses coming onto duty, often in the ward office. Much of the information shared is routine and potentially subjective. The information says little about individual patients’ needs.

The current emphasis of “individualized care” has led to increasing popularity of the bedside hand-over. The idea behind this “patient-centered” approach is to improve the quality by involving the patients in sharing the information. It is widely believed that bedside hand-over enables oncoming staff to provide safe and holistic care.

One drawback of the bedside hand-over is that some patients might not want to be the focal point of a discussion. Confidentiality is also another concern expressed by the nurses. The tort of negligence and defamation allows a patient to sue if a breach of confidence is believed to have occurred during the hand-over period. Bedside hand-over has been found to be time consuming compared with the traditional hand-over (Pepper, 1978). However, this does not seem to be the case for the ward under study here.

Even though the original idea of bedside hand-over is to help cultivate a “patient-centered” culture in the hospital, Cahill (1998) found that nurses often neglected the psychological and emotional aspects of patients in the bedside hand-overs. In fact, it was common that nurses made inaccurate interpretations of the psychological status of the patients to their colleagues during ward rounds (Whale, 1993). Cahill’s findings also indicated that patients did not feel they had sufficient understanding of their illness to enable them to initiate dialogue or converse during bedside hand-overs.

The use of tape-recorded hand-over is less common in Hong Kong. This system of hand-over was introduced in an attempt to minimize the overlap between shifts that involve a lot of the nurses. The potential benefits of the system are listed in Table 6.

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- The nurses handing over can record their report at a time that suits them.
  - Only the oncoming staff is involved. The nurses already on duty can help use the time to help patients and prevent disruption of the report.
  - It provides more flexibility with time for breaks or to leave early to claim back time owing.
  - The tape can be repeated to allow flexibility for start of shift times.
  - With practice, the information given is consistent in format and quality.
  - The information can provide an update for doctors on all of the patients on the ward each day.
  - The information can be updated according to staff mix, for example, more in-depth information can be recorded for bank or agency nurses (see later for discussion on agency nurses).

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Table 6. The benefits of tape-recorded hand-overs (Prouse, 1995).

A pilot study was carried out in a ward for one month implementing the tape-recorded hand-over between early and the late shifts (Prouse 1995). The reporting nurses would start to gather information from their colleague two hours before the beginning of the next shift. After half-an-hour of information gathering, they would start taping. Those who did the reporting were generally RNs who gathered information from the HCAs about the patients in their team. At the beginning, the nurses might need to prepare a “script” of important points. However, as they felt more comfortable, the process became unnecessary. The pilot study went very successful. Staff believed they paid more attention to the tape-recorded hand-over. Since there was no longer a need to have all available staff meeting up for the entire handover period and those who were reporting used much less time, as much as 50% more nursing time was available during the hand-over period.

### **4.3 Phase III: Expert Opinions on Alternatives Raised**

#### *4.3.1 Shift Hours*

The authors believe that it is not a good idea to move to a 12½- hour shift system due to the likelihood of the end-of-shift tiredness affecting the quality of care as well as the health of the nurses. Furthermore, a nurse working on day shift today will expect to work the same shift in the very near future, meaning that she/he will work with the same group of nurses everyday. The WM also expressed in the interview a concern about the possibility of conflicts in relationships that might arise under this arrangement.

### 4.3.2 *Shift Rostering*

One could argue that the fixed rostering system would give the most sense of control of nurses over their time. However, adopting the fixed rostering system would result in the same problem in relation to a nurse having to work with the same group of people every day. Therefore, the authors suggested a rostering system, if there would be any change, to move closer to a flexible system. The WM agreed that the fixed rostering system was not a good idea. Their current rostering system lies between the irregular and the flexible system and nurses are generally happy with it.

### 4.3.3 *Intershift Hand-Overs*

The bedside hand-over is again working fine in the ward. Confidentiality is regarded as something that needs to be compromised for the improvement in the quality of care achieved under this approach.

The tape-recorded hand-over was actually experimented for a period of approximately one month some time ago in the ward. However, the outcomes of the trial were much less impressive than the case presented by Prouse (1995). Nurses complained that it was inconvenient for them to share just one tape-recorder. At times, they also found themselves unsure of which tapes they had already listened to and which ones they had not.

## 4.4 Discussion

### 4.4.1 *Shift Hours*

As mentioned earlier, the 12½- hour shift system has many disadvantages. It is recommended, therefore, that the public hospitals should keep the current system of 7 - 7½ - 10 shift system. Since the 7 - 7½ - 10 shift system has a number of significant advantages over the 3 × 8 shift system, it might be a good idea to gradually eliminate the existing use of the 3 × 8 shift system that remains for various management reasons.

### 4.4.2 *Shift Rostering*

The authors agree that the current rostering system is working fine. However, it is worthwhile to move to a more flexible rostering system to improve the job satisfaction of nurses. With better control over the use of their own time, nurses will show more commitment to their work and thus improve the quality of care they provide to patients. To take into consideration the many requests and preferences of the nurses in shift rostering will be very time consuming if done manually. Therefore, it is suggested that a computer program for rostering shifts should be developed for this purpose (refer to the next section for more detailed analysis on computerization of shift rostering).

### 4.4.4 *Intershift Hand-Overs*

It is agreed that bedside hand-over is doing fine in the ward under study. So long as nurses mindful of the danger of careless talks in the ward, the system should

not be changed. However, nurses should put more efforts in involving the patient in the hand-over, if the patient is willing to, of course. Otherwise, the true meaning of bedside hand-over may be lost. It is suggested that hand-over of information should not only include medical reporting of the physical status of the patient and technical jargons should be avoided where possible.

By simple calculation, if 10 nurses are involved in a hand-over for 15 minutes (if reality, this is often exceeded), the total human-hours consumed is 2.5 hours. Given the number of shifts each day and the number of nurses in one hospital, the human-hours spent in hand-over can amount to a huge figure in the long run. The authors, therefore, are supportive of the idea of the tape-recorded hand-over, even though it has been tried before and turned out to be less efficient than expected. With the tape-recorded hand-over, nurses are given some level of flexibility as to when they listen to the tape, and hence, there is more room for better time management. Time spent on hand-overs can be saved, somewhat helping lessen the problem of shortage of nurses faced by many public hospitals nowadays. It is believed that with careful implementation and support of all staff, the new approach can be successfully carried out. Some other benefits that tape-recorded hand-over brings are listed in Table 6 and are not repeated here.



## **5. COMPUTERIZATION OF NURSE SHIFT ROSTERING**

### **5.1 Phrase I: Current Situation**

The use of computer in shift rostering is minimal. For example, in the Obstetric Ward, the WM performs shift rostering in her unit manually and consumes a lot of time in this process. For the ward of 6 NOs, 47 RNMs and 1 Pupil RNM, it generally takes about 2 working hours per week and involves several parties in the process. As described earlier, the WM first plans all the Night shifts within the month. This step usually takes half an hour. Secondly, the WM schedules the AM and PM shifts weekly. This step usually takes half an hour per week. Thirdly, the nurse of lower rank manually copies the schedule and makes several photocopies. This step usually consumes 10 to 15 minutes per week. The Ward Steward then fills the schedule sheet with different colors. This step usually counts half an hour per week. Finally, the NO uses half an hour to plan for the nurse job assignment.

The parties involved and time consumed by scheduling nurse shift in the obstetric ward for a month is summarized in figure 3. The total time needed is approximately 7.5 hours.

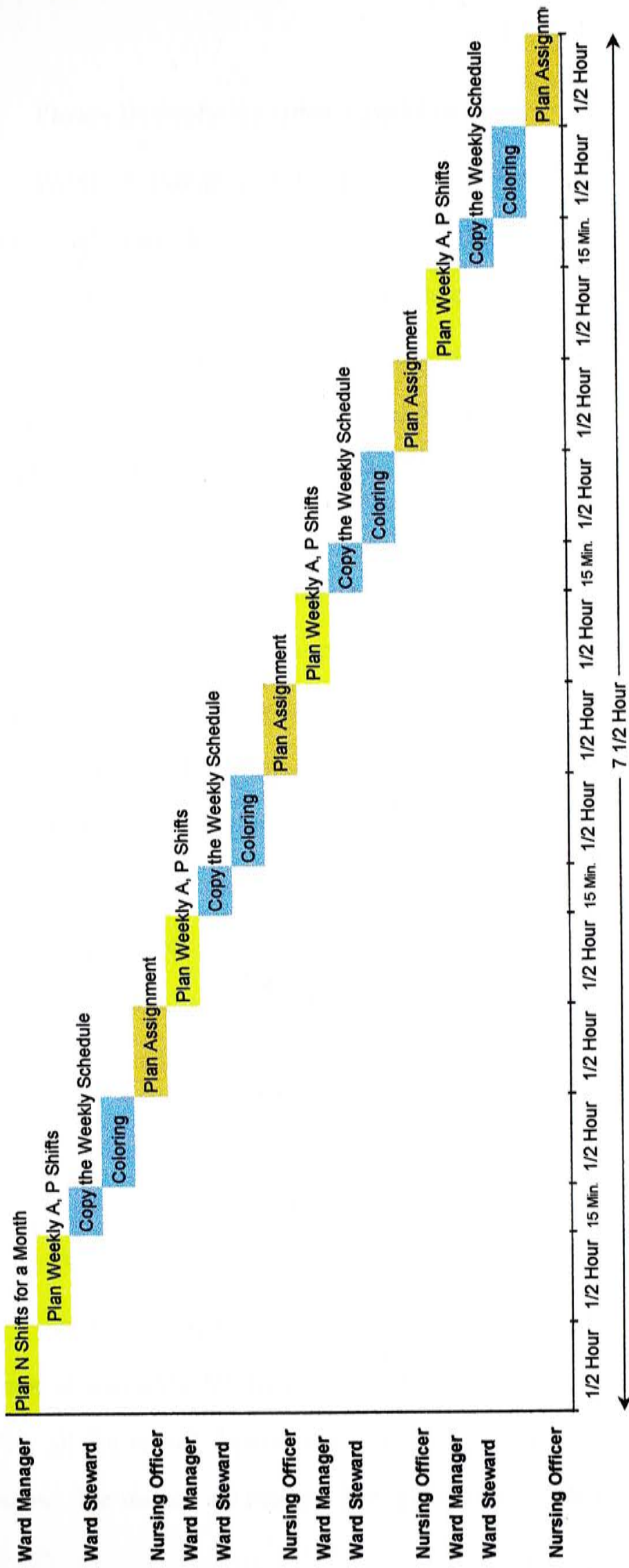


Figure 3. The Monthly Time Consumption of Nurse Shift Scheduling

## **5.2 Phrase II: Exploring Other Possibilities**

Plenty of examples around the world show that "computers in nursing" is possible and great improvement can be obtained in terms of both quality and efficiency as a result. In Taiwan and the United States, computers are often used to schedule nurse shifts and even job assignments. Most importantly, the scheduling pattern in those hospitals is similar to Hong Kong hospitals: there are also three shifts: AM, PM and Night and flexible rostering method is largely employed.

Many operations researchers have proposed mathematical programming models for nursing human resources decisions, for example, Linear Programming (NP) and Integer Programming (IP) (Huarng, 1999). Other approaches include heuristic rules (Randhawa and Sitompul, 1993) and computerized expert system in Taipei Veterans General Hospital (National Tsing Hwa University) (Huarng, 1999) to solve nurse scheduling problems. It is suggested that the Hospital Authority should refer to these cases and design a computer program that helps eliminating the unnecessary clerical tasks (such as coloring and photocopying), and most importantly, the decision making part of rostering, saving valuable nursing time.

## **5.3 Phrase III: Expert Opinions on Alternatives Raised**

In fact, in March 1999, the Prince of Wales Hospital already employed computer scheduling for nurse shift rostering. However, after a meeting in October 1999, all the related departments agreed to cease using the computer scheduling system. The reasons are twofold: first, the system is inflexible and second, bugs are

found. As a result, manual adjustments are often needed after the computer generation of the roster, and ironically, much more time is wasted instead of saved.

According to the WM of Obstetric Ward, the most important function of the computer to the ward right now is as a typewriter. The computer makes no decision making, let alone scheduling for the ward.

## **5.4 Discussion**

### *5.4.1 Feasibility of Computerization*

Although the previous computer scheduling system fails to perform its functions, the authors are still optimistic about computerizing the nurse shift rostering system.

Firstly, the previous computer system is claimed to be inflexible. The major reason may be due to the numerous special considerations in the nurse shift scheduling. For instance, a Christian nurse may want to avoid Sunday morning shifts since she has to go to church. For manual scheduling, WM can liberally assign the shift according to individual nurse's request as much as possible. However, this may not be achievable by the computer if consideration of such requests is not incorporated into the system. Secondly, bugs are found in the previous computer system, affecting the efficiency and quality of the computer generation of the roster. In fact, with deeper insight and careful design, a system can easily be developed to solve the above two problems. The key is thorough understanding of the requirements of the nurses by the computer analysts. Given the success example of the use of an optimization-based decision support system, using integer search in

patrol officer scheduling by the San Francisco Police Department which resulted in revenue increase of US\$3 million per year (Taylor & Huxley, 1989), it is hard to see why a similar application of operation research is impossible in the nursing field.

#### *5.4.2 Development of a Seamless Computer Scheduling Model*

Since there are so many special considerations that need to be taken in order to develop a flexible computer rostering system, thorough investigation is necessary before proceeding the development. The following are some points that need to be emphasized in the development process. The actual programming, however, is out of the scope of this study.

Firstly, we should define the objectives for the model. Satisfying the daily minimum staff needs would be an appropriate one since it is the basic and strict requirement to ensure enough nurses on duty to meet a minimum level of work generated each day. The daily staff needs may vary from ward to ward, from hospital to hospital, and changes may occur in the passage of time. Therefore, the system should allow the user to input the daily minimum requirement as a variable.

Secondly, tailor-made constraints should be put into the model in order to obtain an optimal result and facilitate flexibility. The hospital guidelines must be strictly followed. For example, nurses' working hours should not be more than 44 hours per week; consecutive shifts should be avoided; PM shifts in three consecutive weekends are prohibited; and a week should contain no more than four AM shifts and four PM shifts. Unfavorable shift patterns like: PM-Off-Night, AM-Night-AM, PM-Off-AM should also be avoided. There are many conditions and constraints in

scheduling nurse shift system. Whether a successful computer system can finally be achieved heavily depends on the communication between the developers and the users. Two-way communication, ask and contribute, give and take, is necessary during the whole development process.

Thirdly, special concerns should also be considered. For example, different shift periods may appear in different departments and even within the same ward, depending on whether a nurses is under the 7 - 7½ - 10 shift system or the 3 x 8 shift system. Normally, nurses in the obstetric ward work on the 7 - 7½ - 10 shift system. However, student nurses in the obstetric ward and all nurses in the surgery ward work on the 3 x 8 shift system.

Still, some considerations like emergency day-off requests should be satisfied as much as possible. In other words, fine tuning should be allowed in the system to meet human needs such that flexibility can be maintained in all circumstances.

After identifying all the guidelines, concerns and problems, a user-friendly interface should be another very important issue to look at.

## **6. NURSE RESOURCES POOL**

### **6.1 Phrase I: Current Situation**

Nursing staff shortage has long been a problem in Hong Kong's health care environment. Newspapers constantly report that hospitals are seriously under-staffed and the health care delivery quality is degraded due to inadequate services provided. Recently, accumulation of compensatory-offs and holiday-offs owed to nurses has been found to be very serious in some hospitals. One of the public hospitals in Hong Kong owes nurses a total of 5,000 days off<sup>4</sup>. The public worries that the number of medical accidents might increase because of negligence due to insufficient nursing resources.

The Prince of Wales Hospital Obstetric Ward considers nursing human resources shortage as a problem, though their problem is not as serious compared to other hospitals. The problem originates from fluctuation of needs. In the Obstetric Ward, the main duty is handling baby deliveries. This is, apparently, an unpredictable event. Sometimes, babies come out all at the same time, and sometimes no baby comes out during the entire shift. In addition, the headcount is generally quite tight, merely enough for maintaining daily normal operations. Therefore, the situation can get very bad during the peaks. When some nurses happen to take sick leave, the ward would become seriously under-staffed. This can easily be understood by looking at the very urgent job nature of nursing. Unlike office work, medical operations cannot be waited. Sometimes a delay of one minute of care can be fatal to life.

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<sup>4</sup> Apple Daily, 29 March 2000.

There is also owed holiday-offs accumulation in the Obstetric Ward. It has once been at the three digits level but now down to a two digits position. The annual leave policy for nurses in the Prince of Wales Hospital is that only 10 days annual leave can be brought forward to the following year. However, compensatory-offs can all be brought forward for more than one year.

## **6.2 Phrase II: Exploring Other Possibilities**

There are two possible solutions to this issue. Firstly, freelance nurses can be hired to solve temporary staff shortage. In the overseas example, early-retired nurses formed an organization to supply hospital nursing service. Secondly, internal nurses allocation between different departments can also be used to manage fluctuating demand.

In the United States, there exist organizations like nursing agency that a hospital can call for extra nurses to temporarily resolve its nursing shortage. These nurses are often paid at a higher hourly wage but inconsistency in quality of delivered care is common. Inconsistent practice and treatment by part-time nurses may lead to serious mistakes. Therefore, the standard and experience of nursing agency must be carefully examined.

Another possibility may be to develop a nursing resource pool within the hospital. This pool acts as a contingency action team. The idea is like nurses from different department participating in the resource pool program. Regular training and meetings are held to cross-train the pool members different skills required by different



departments. The advantage of this option is that nurses can keep up-to-date information about current practices. Thus, quality can be more easily maintained. On the other hand, nurses participating in the program can have an additional means to explore other opportunities to develop different skills and interests.

### **6.3 Phrase III: Expert Opinions on Alternatives Raised**

According to the WM of Obstetric Ward, the Prince of Wales Hospital adopted the nursing agency some years ago. There was an agency that supplied freelance nurses for several hospitals including the Prince of Wales Hospital. Hospitals could call for temporary helpers in emergency needs. However, due to the contracting budget and healthcare reform, this scheme was abandoned.

Before the healthcare reform, in the Prince of Wales Hospital, all the nursing issues with the hospital were managed under a General Managing Director (GMD). Therefore, the budget for nursing was centrally controlled for the whole hospital, regardless of departments. There was an old practice that nurses were required to shift among different departments after several years of service. Thus, when one particular department is suddenly under-staffed, there is no problem to find experienced nurses from other departments as a temporary solution. Since the health care reform, however, each department is entitled a certain amount of budget per year.

The internal rotating system is abandoned due to several reasons. First, the separation of departmental budget makes it difficult to differentiate the rotating nurses headcount. Second, the Hospital Authority aims at developing a team of

“specialized” nurses. In other words, nurses often work for the same department for many years and there is not much prospect in changing departments. The new program is towards a more cost-effective approach. Specialty is followed by professionalism in nursing and nurses can now perform part of the duties that used to be doctor's job. Ultimately, quality of care can be achieved instead of just maintaining patient's physical well being. However, flexibility of nurse allocation between departments is reduced as a result of the restricted field in career development.

## 6.4 Discussion

After obtaining further understanding of the situation, we refined our proposal into a nursing resources plan.

The objective of developing the nursing resources plan is to meet the fluctuating needs of nurse and/ or patient volume *within* a ward. The foundation of the plan is in the ward level instead of the hospital level. The mission of the resources pool is to supplement the “core” staffs in a ward who are on leave/ absent and to provide additional staff during periods of high patient volume. According to the WM of Obstetric Ward, unscheduled time offs such as sick leave, and scheduled time offs such as maternity leave always make staff allocation a headache. The WM claims that Obstetric Ward can only withstand a maximum of three nurses on maternity leave at any one time out of the about sixty staff members in the ward.

There are two pools in the plan: internal and external. When there is staff shortage in one particular ward, the internal pool is first utilized. If the requirement is not met, then we resort to the external pool.

For the internal pool, nurses are recruited from different departments according to their personal preference. In addition to rotating within one department on normal days, team members gain other departments’ different culture and practices by:

- regular meetings;
- short-term cross training; and
- departmental nursing protocols.

By regular meetings, team members can exchange knowledge and up-to-date information. Short-term cross-training programs may involve several hours of field practice and observation. Departmental nursing protocols help team members to learn the instructions stipulated by a department and it also acts as a guideline for care delivery. These three methods enlighten nurses about other departments' operations while not affecting their core competency development. When a ward urgently needs additional nurses, it can make a request to the team and wage is paid to the selected nurse from the team on an hourly basis.

For the external pool, nurses who quit the job for family reasons can register as freelancers and provide temporarily service for the hospitals where they used to work. According to the WM, the Midwifery Association constantly holds refresher courses for both members and non-members to review new development and technology of the industry. Therefore, nurses can keep up with the industrial development even though they do not work full-time.

The nursing resources plan can be further refined by developing "nurse need projection" and "patient volume projection". Historical data analysis can be done to predict which group(s) of nurse may have high unscheduled absence rate. In addition, special events such as examination period for a certain group of nurses should also be taken into account. In sum, the aim of nurse need projection is to help identify any seasonal pattern in the nurse need fluctuation. The same procedures also have to go through for the patient volume projection. Special patterns like more pregnancy is expected in the Chinese Dragon Year, endemic usually spreads in the summer, etc. The two projections will help the WM to predict the service demands (patient

volume) and deficit demands (nurse shortage) and allow her to respond to the needs accordingly.

To implement this nurse resource plan, the WM would need additional fund. However, the future benefits of such a scheme is believed to be much greater than the implementation cost as well as the maintenance cost of the plan.

## 7. CONCLUSIONS

After the health care reform, there are generally tighter financial controls in public hospitals in Hong Kong. As a result, many hospitals experience shortage of resources. With the salary of Nurses being a major expense item, a good nursing management is essential. The aim is to improve the productivity of nurses as well as providing flexibility in the nursing resource management system.

### 7.1 Shiftwork

The use of a tape-recorder to hand-over will reduce the overlap between two shifts. Thus, more nurses will be available during the intershift period, helping lessen the problem of shortage of nurses to a certain extent. Moreover, under this hand-over mechanism, nurses will given some level of flexibility as to when they record or listen to the tape, i.e., there is more room for better time management.

Another recommendation in relation to shiftwork is to have the scheduling of nurses moving towards a flexible rostering system. This recommendation is not concerned with the key problem of shortages in resources. Rather, the aim is to create more job satisfaction and sense of commitment for nurses. Thus, higher quality of services can be expected of them.

The 7 - 7½ - 10 shift system has a number of advantages that make it popular among the nurses, e.g., reasonable duration of working time, better fit to nurses' sleeping habits, etc. Therefore, the authors believe that the shift system should

remain. It might also be a good idea to gradually eliminate the existing use of the 3 × 8 shift system that remains for various management reasons.

## **7.2 Computerization of Nurse Shift Rostering**

It is suggested the scheduling nurses' shifts should be performed by the computer in order to save time wasted on clerical tasks that take away valuable time of nurses. The authors suggested various Operations Research techniques that may be appropriate in the hospital setting in Hong Kong. These techniques include Linear Programming, Integer Programming, Heuristic Rules. A combination of various techniques may be necessary to provide the best optimization system. The authors also suggested a set of objectives should first be established, then constraints such as the number of Nights shifts in a week, the number of working hours in a week, etc., are used to build up the model. The optimization system should incorporate some degree of flexibility in it to allow for unanticipated day-offs requested by the nurses. Finally, the system should be user friendly to ensure that the nurses do not require too much training in order to feel comfortable using it.

## **7.3 The Nurse Resources Pool**

Different departments have their periods at different times of the year. When one department experiences manpower shortage, it is best that nurses from less busy departments or from outside the hospital can join forces to help out. Tackling shortages problem in this way increases flexibility in utilizing nursing resources while

avoiding the need of employing additional full time nurses, which is obviously more expensive. Since sourcing from within the hospital is less costly, it is recommended that the external pool concept should be implemented as the last resort.

Beside rotation within their own departments, nurses in the internal will also rotate between different departments. These nurses will gain knowledge of other departments' distinct culture and practices by regular meetings, short-term cross training as well as the learning of various departmental nursing protocols. Nurses from the external pool, on the other hand, will be required to enroll in refresher courses provided by schools and institutions concerned to keep themselves up-to-date with new development and technology of the industry.

Finally, historical data should be used to obtain "nurse need projection" and "patient volume projection" so as to better match the supply and demand of nursing resources.



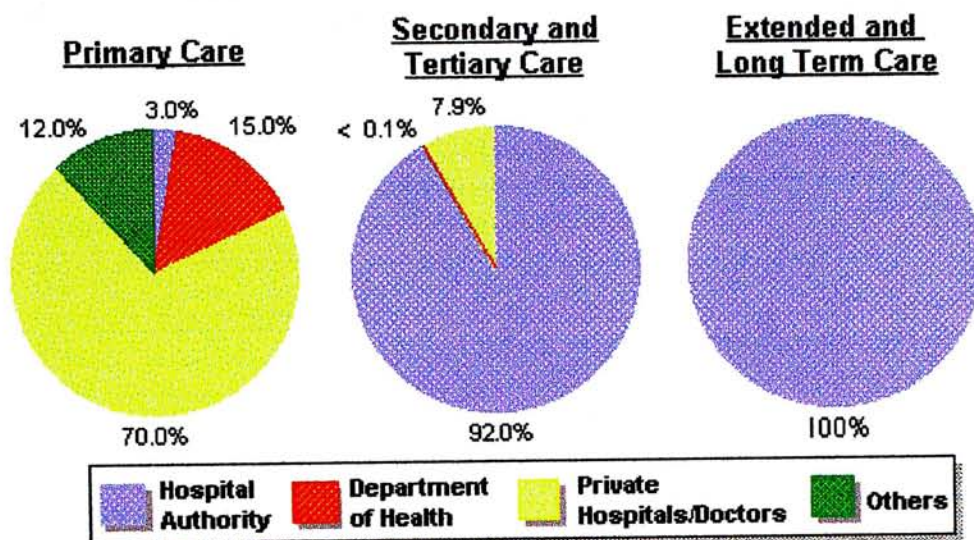
## **APPENDIX A      HEALTH CARE SERVICES**

Hong Kong's Health Care Services can be classified into primary, secondary, tertiary levels with acute and extended care components.

- Primary Care**      Refers to the patient's first point of contact with the health care system and includes family (general) practitioners, health nurses and pharmacists. Most illnesses can be treated at the primary care level.
- Secondary Care**      Refers to the more specialized and complex medical care which is usually provided in a hospital setting. Patients requiring secondary care are normally referred by primary care practitioners.
- Tertiary Care**      Caters for a small proportion of patients requiring highly complex and specialized care.
- Acute Care**      Provides treatment to patients in the acute stage of illness to restore health. Treatment can be delivered at primary, secondary and tertiary levels of medical care.
- Extended Care  
(Rehabilitation  
and long stay)**      Provides medical rehabilitation to the disabled, chronically ill and elderly in either institutional or community settings.

**APPENDIX B**

**HEALTH CARE SERVICES DISTRIBUTION**



The Hospital Authority provides over 90% of secondary and tertiary care in Hong Kong. The Department of Health and the Hospital Authority cater for approximately 15% and 3% respectively of primary medical care. The private sector provides 70% of primary medical care and under 10% secondary and tertiary care. Extended and long-term care are provided almost exclusively by the Hospital Authority.



APPENDIX D

WEEKLY DUTY LIST

Rank	20/3	21/3	22/3	23/3	24/3	25/3	26/3 Sun
NO	N						
NO		N					
NO			N				
NO				N			
NO					N		
NO						N	
NO							N
NO							
WM	D	1/2D PM VL	D	D	D	HD	C
NS	D	D	SD	D	D	FD	C
NO	A <sup>R</sup>	Dec	P	A	N <sup>4</sup>	C	P
NO	P	A	N <sup>2</sup>	P	A	C	3 Feb
NO	CO2	C	P	P	A	N <sup>1</sup>	1 Feb
NO	C	P	A	N <sup>4</sup>	<del>A</del>	P	A
NO	A	N <sup>5</sup>	CO2	C	P	A	P
NO	1 Dec	P	A	A	C	P	A
Ag. NO.	P	A	N <sup>1</sup>	C	P	A	CO2 <sup>R</sup>
RNM				AL			C
RNM				AL			C
RNM	A	N <sup>4</sup>	O <sup>R</sup>	P	P	A	P
RNM	A	P	A <sup>1</sup>	P <sup>R</sup>	A	N <sup>3</sup>	O <sup>R</sup>
RNM	P	A	P	A	C	P	A
RNM	P	A	N <sup>2</sup>	A	O <sup>R</sup>	P	A
RNM	A	P	A	N <sup>2</sup>	P	A	O
RNM	A	P	A	N <sup>1</sup>	O	P	A
RNM	N <sup>5</sup>	P	A <sup>R</sup>	O <sup>R</sup>	P	A	N <sup>1</sup>
RNM	P <sup>R</sup>	A	P <sup>R</sup>	A	A	N <sup>2</sup>	O <sup>R</sup>
RNM				SL			
RNM	C <sup>R</sup>	P	A <sup>R</sup>	A	CO1 <sup>R</sup>	P	C <sup>R</sup>
RNM	C <sup>R</sup>	P	P	A	N <sup>3</sup>	P	A
RNM	P	A	P	A	N <sup>3</sup>	O	P
RNM	A	N <sup>5</sup>	O <sup>R</sup>	P	A	CO2	A

N

N<sup>5</sup>

N<sup>4</sup>

N<sup>1</sup>

Rank	20/3	21/3	22/3	23/3	24/3	25/3	26/3 Sun
RNM	O <sup>R</sup>	P	A	D3 <sup>R</sup>	JAN <sup>R</sup>	P	A <sup>N3</sup>
RNM	A	N <sup>3</sup>	O	P	A <sup>R</sup>	CO1	P <sup>R</sup>
RNM	A <sup>R</sup>	SD 1400-1645	P	A1 <sup>R</sup>	O <sup>R</sup>	P	A <sup>N2</sup>
RNM	SD 400-1635	A <sup>R</sup>	P	A <sup>R</sup>	A	N <sup>5</sup>	O
RNM	N <sup>5</sup>	CO2	O <sup>R</sup>	P	P	A	P
RNM			AL				
RNM	F	A	A	N <sup>3</sup>	P	O	P
RNM	P	A	N <sup>4</sup>	O	P	A	P
RNM	P	A <sup>R</sup>	P	A	N <sup>3</sup>	O <sup>R</sup>	P
RNM	N <sup>3</sup>	CO1	A <sup>R</sup>	F	O <sup>R</sup>	A	N <sup>4</sup>
RNM	A	P	A	O	7-2 <sup>15</sup>	A	N <sup>1</sup>
RNM	N <sup>1</sup>	P	CO1	O	P	A	N <sup>2</sup>
RNM	P	O	P	A	N <sup>3</sup>	CO1	A
RNM	A	F3	A1	P	A	A	O <sup>R</sup>
RNM	A	A	N <sup>1</sup>	CO2	P	P	O
RNM	P	P	A	N <sup>4</sup>	O	A1	P
RNM	P	A	A	N <sup>3</sup>	O	A <sup>R</sup>	CO1 <sup>R</sup>
RNM	A	N <sup>1</sup>	O <sup>R</sup>	P	A <sup>R</sup>	P	A <sup>N2</sup>
RNM	P	A	N <sup>3</sup>	CO1 <sup>R</sup>	O <sup>R</sup>	P	A <sup>R</sup>
RNM	P	O <sup>R</sup>	A	P	A	N <sup>5</sup>	CO2 <sup>R</sup>
RNM	A	P	P	A	N <sup>4</sup>	CO1	O <sup>R</sup>
RNM	F2	P	A	O <sup>R</sup>	P	A	P
RNM	N <sup>4</sup>	O	P	P	A <sup>R</sup>	A	N <sup>5</sup>
RNM	P	A	F1	O	A	N <sup>3</sup>	P <sup>R</sup>
RNM	CO1	O	SD	A	N <sup>5</sup>	CO2	P
RNM	CO2	P	A	P	A	N <sup>4</sup>	O <sup>R</sup>
RNM	A	N <sup>3</sup>	CO1	P	P	O	P
RNM	N <sup>2</sup>	A2	P	A	P	A <sup>R</sup>	O <sup>R</sup>
RNM	A	N <sup>4</sup>	O	P	A <sup>R</sup>	P	A <sup>N5</sup>
RNM	A3	A	N <sup>2</sup>	O	P	AL	AL
RNM	F1 <sup>R</sup>	O <sup>R</sup>	P	A	P	A	N <sup>5</sup>
RNM	P	A	A	N <sup>3</sup>	O	P	A <sup>R</sup>
RNM	A	O	P	A	A	N <sup>3</sup>	CO1 <sup>R</sup>
	15 14	14 13	14 13	14 13	14 13	14 12	12 12

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