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Investigation of the Effects of the Built Environment on Patient Health Outcomes and Staff Satisfaction

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Abstract

Medical professionals claim that improvements to the built environment of health facilities have positive effects on patient health outcomes and staff satisfaction. Despite extensive research, inadequate empirical evidence exists to support the benefit of renovation. The Department of Human Services, Victoria, Australia, needs assurance that investment in facility improvement is worthwhile. Through literature review, interviews, and focus groups, a methodology consisting of evaluation tools, surveys, and data organisation tools was developed and pilot tested for the collection of data from facilities targeted for replacement. A framework was established for follow-up studies to be performed in renovated facilities.

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Glossary of Terms

Acute:	Used to describe a severe, short-term illness or condition; an acute care ward (as opposed to chronic) is one whose patients are there for a short period of time.
Analgesics:	Medications used for pain relief.
Empirical:	Refers to evidence or data that is based on experimental observation, and is not necessarily based on previous scientific theory.
Inpatient:	A person who has been admitted to a hospital for at least a 24-hour period.
Level 5:	From role delineation of a capital planning model; a major teaching hospital that experiences 20,000 to 30,000 separations (discharges) per year and has 250 to 400 beds.
Level 6:	From role delineation of a capital planning model; a major teaching referral hospital that experiences more than 50,000 separations (discharges) per year and has more than 400 beds.
Likert:	A scale often used in surveys that requires participants to quantify their agreement with a particular statement.
Nosocomial:	Hospital-acquired, or originating in the hospital; used to label an infection not present or incubating prior to but occurring more than 72 hours after admittance.
Schedules 4 and 8:	The “Schedule” of a drug refers to its potential for misuse; a Schedule 8 drug is a controlled drug with a high potential for misuse, and a Schedule 4 drug is a prescription medication available from a pharmacist.
Tertiary:	Refers to a healthcare facility that is able to provide highly specialised services.

Executive Summary

The field of modern healthcare architecture is advancing through the discovery of links between healthcare facility design and both patient health outcomes and staff satisfaction. Literature reports that factors such as the number of patients per room, availability and number of handwashing facilities, presence of windows, and allocation of personal space can have significant impact upon patient and staff well-being. Medical professionals advocate for the renovation of existing facilities or construction of new facilities in accordance with these research findings. Although a large volume of research investigating the impact of specific environmental factors exists, it is difficult to predict the overall effect of numerous changes to a specific physical setting. The development of a standardised method for evaluating the impact of the environment is complicated by the fact that each healthcare facility has unique demographics and services.

The Capital Management Branch (CMB) of the Department of Human Services (DHS) in Victoria, Australia is responsible for the allocation of funds for proposed renovations of healthcare facilities in the state. Through their Asset Investment Program, the CMB dictates the financial planning, design, and construction of buildings. With such large quantities of capital at stake, proposed system-wide improvements must be justified prior to implementation. Observation of improved patient health outcomes and staff satisfaction would support investment in such areas and allow CMB to ensure effective usage of capital. Thus, the need arose for a standardised assessment of the effects of healthcare facility renovation efforts on patient health outcomes and staff satisfaction.

Project Goal and Objectives

The goal of this project was to create and implement a methodology that would enable empirical assessment of the built environment of a healthcare facility and its effects on patient health outcomes and staff satisfaction. Providing such a means for empirical assessment required research, data collection, and analysis. Due to the time implications associated with evaluating a facility before and after renovations are made, the study was divided into two major projects. The primary objectives of this project were to:

- perform a review of existing literature investigating possible relationships between the built hospital environment and both patient health outcomes and staff satisfaction;
- develop a methodology to enable the empirical assessment of five major outcome measures: patient length of hospital stay, usage of analgesics, incidence of nosocomial infection, patient satisfaction, and staff satisfaction;

- implement the developed methodology to collect baseline data in two healthcare facilities which will be renovated within four to six months; and
- create the framework for the second project, which will collect data from the renovated facilities, enabling the compilation and analysis of pre- and post-renovation data.

A subsequent project, to be completed in early 2006, will entail the collection of follow-up data using the developed tools and analysis by comparison of data collected before and after facility renovation.

Development of Methodology

In order to fulfil the requirements for the first project, various methods of research, study design, and data collection were employed. Through literature review, interviews with staff members at CMB, and preliminary hospital site visits, we were able to examine and familiarise ourselves with numerous aspects of the built environment, including windows, noise, ward layout, room layout, room size, positive distractions, environmental surfaces, aesthetics, wayfinding, cleanliness, lighting, and ventilation; we also investigated their reported implications on patient health outcomes and staff satisfaction. Upon synthesis of this information, we identified detailed components of the physical setting for consideration in our methodology.

Following consultation with CMB staff members through interviews and focus groups, as well as preliminary hospital site visits, we were able to determine hospital-specific information regarding the nature, motivation, and timeline of renovations. This information eliminated certain hospitals that were under consideration whose renovation schedules were not appropriate for the timeline of our study. Also through these interviews and focus groups, we were able to determine the availability of our desired quantitative health indicators and feasibility of methodology implementation at each hospital.

Information gathered from the literature review and focus groups and interviews with members of the Capital Management Branch was used to develop a comprehensive methodology for investigating the effects of the built environment on patient health outcomes and staff satisfaction. This methodology includes tools to conduct building evaluations, assess patient and staff satisfaction, and collect information regarding the average length of hospital stay, usage of analgesic medication, and incidence of nosocomial infection.

A building evaluation tool was created to enable objective comparison of the environments of healthcare facilities before and after renovations, allowing different outcomes to be linked to environmental differences. Information to be gathered through this tool was determined by

findings of our literature review and CMB interviews and focus group. This tool serves to evaluate pre- and post-renovation facilities and also helps to familiarise future researchers with previously existing ward conditions.

We designed surveys that could assess patient and staff satisfaction with the built environment. The particular environmental factors addressed in these surveys were determined by the findings from our literature review, interviews and focus groups with CMB personnel, and feedback from hospital staff during our preliminary site visits. Patients were asked to rate their satisfaction with certain elements of the built environment on a Likert scale. We asked staff members to rate certain aspects of the physical setting in terms of effect on their ability to deliver services, personal satisfaction, and how they perceive the patients' satisfaction to be affected.

The desired quantitative health indicators – average length of hospital stay, usage of analgesic medication, and incidence of nosocomial infection – are often used as key performance indicators for hospitals. An assessment tool was not necessary to gather data for these indicators, as data collection relied more upon contact persons in appropriate departments within the hospitals. Because this information is not collected in a standardised manner, specific contacts were made at each hospital to facilitate the acquisition and interpretation of these data.

Information gathered by literature review, interviews, the focus group, and hospital visits was used to narrow the scope of the project to vital environmental factors around which our methodology could be based. With this knowledge, we were able to develop the methodology in such a way that the built environment was evaluated specifically in terms of its effects on patient health outcomes and staff satisfaction.

Collection and Organisation of Baseline Data

Following its development, we implemented this methodology for the purpose of baseline data collection. We evaluated existing adult acute inpatient medical wards at two hospitals within the metropolitan area of Melbourne, Australia: the Royal Melbourne Hospital and the Dandenong Hospital. Such implementation also allowed us to perform an initial assessment of the feasibility, applicability, and sustainability of the tools we developed.

The timeline of our project limited the data collection period to two weeks; we dedicated one day per week to gathering data from each hospital facility. Patient satisfaction surveys were administered via face-to-face interviews with the patients in an attempt to keep their interest and increase response rate by allowing patients not physically capable of completing the

survey the opportunity to participate in our study. Staff satisfaction surveys were completed independently at the convenience of staff members, because staff members are often busy throughout the course of a day. This administration technique also allowed us to survey staff members from a variety of shifts. The data collected from patient and staff satisfaction surveys were aggregated in the form of a database to allow for ease of data entry, access, and analysis. Queries were written and run on this database, and the resulting information was incorporated into summary spreadsheets to facilitate analysis during the follow-up study.

The building evaluation tool was used to perform an objective of both the condition and quality of the physical environment of a hospital. Through individual observation and the questioning of building engineers, we were able to obtain information concerning each hospital site prior to its renovation or relocation. Results of the building evaluation were presented in the form of a spreadsheet, and in the interest of comprehensibility, this information was used to create a descriptive narrative of each facility

Data regarding analgesic usage and length of patient stay for the past six months were collected at both hospitals. However, nosocomial infection data were unavailable due to complexity and lack of robustness on a ward level. The acquired data pertaining to the available quantitative health indicators were entered into appropriate spreadsheets to serve as a method of baseline data transmission to the follow-up researchers.

Establishment of Framework for Follow-up Study

Completion of a framework for the follow-up study involved the development of a user's manual, which will familiarise future researchers with the methods that were used to collect the baseline data. This manual provides guidelines for data collection from renovated facilities and facilitates a direct completion of the follow-up study. A majority of this manual details the use of our project's deliverables – the patient and staff satisfaction surveys, the building evaluation tool, and the tools for data organisation; however, the manual also explains the means by which quantitative health indicators – levels of analgesic usage, patient length of stay, and instances of nosocomial infection – are to be recorded. The contents of the manual include a brief overview of our project and the procedures we used. For each survey and the building evaluation tool, there are detailed instructions on how to administer or complete the necessary forms. In addition, the user's manual contains screenshots of the data organisation tools we developed and instructions on how to use this software. As a convenience, our software tools and surveys are included on a CD-ROM which was bundled with the user's manual.

Potential Impact of Methodology

This project provided the Department of Human Services with the tools necessary to empirically assess the impact of the built environment on patient health outcomes and staff satisfaction. If a significant relationship is discovered through the use of these tools, empirical evidence will support investment in the refurbishment of healthcare facilities. This correlation would allow DHS to justify and better allocate funding, which would improve hospital efficiency.

The methodology was created with Victorian healthcare in mind, but we believe that it may be more generally applicable to adult acute care inpatient wards from which the quantitative health indicators can be extracted. The content of the user's manual was written with a broad enough scope so that it may be used to complete future studies in other facilities. However, if the methodology is implemented in a specialised ward, such as a paediatric or neurosurgery ward, supplementary materials and questions outside of the scope of this project will be required. The possibility for broad implementation warrants further investigation, and may result in significant implications for the impact of this work. Healthcare organisations could potentially utilise modified versions of these tools to assess the impact of renovations to the built environment of healthcare facilities, and therefore allocate funds more appropriately. As a result, quality of patient care could be improved through usage of more efficient healthcare facilities.

1 Introduction

Healthcare facilities, entrusted with the protection of health and well-being, serve as a cornerstone for modern societies worldwide. It is also the responsibility of these facilities to provide resources for patient treatment and recovery. Public investment in a nation's healthcare system is extensive, as taxpayers expect the government to provide quality healthcare coverage and resources. With such large quantities of capital at stake, proposed system-wide improvements must be justified prior to implementation. At the same time, because the healthcare system exists to serve the public, the larger balance between budget and functionality must be achieved.

A modern and highly effective healthcare environment depends upon regular upgrades using properly allocated sources of capital. Recent research endeavours stressing the relationship between health outcomes and facility design present architectural improvement as a strong candidate for such investments. Studies also suggest that improvements to the physical setting can significantly reduce the occurrence of nosocomial, or hospital-acquired, infections and increase other aspects of patient well-being (Ulrich, Quan, Zimring, Joseph, & Choudhary, 2004). As a result, patients in upgraded facilities can expect to experience shorter hospital stays and require reduced levels of medication. However, an individual architectural improvement does not necessarily correlate with a single beneficial result. The design of a healthcare environment has a multifaceted effect on both the physical and mental health of patients and staff. Studies indicate that poorly designed facilities are more conducive to nosocomial infection because of the insufficient number of single-bed rooms, isolation wards, readily accessible handwashing facilities, and enclosed consultation rooms (Berry, Parker, Coile, Hamilton, O'Neill, & Sadler, 2004). Other environmental and architectural variables that may contribute to the satisfaction of patients and staff include the presence of windows, colour[1] of the room, outdoor accessibility, artwork, music, cleanliness, and patient control of the environment (Lawson, 2002; Ulrich, 1984; Maxion, 1989; Haigh, 2001).

The Department of Human Services (DHS), which functions as the authoritative organisation for healthcare in the state of Victoria, Australia, has recognised the potential for architectural improvement of aging healthcare facilities. Through consultation with experts, the Department performs ongoing evaluations of facilities to determine which may need to be upgraded through renovation or replacement. The goal of these upgrades has been to improve the facility's architecture and quality of delivered services; however, no mechanism has

[1] This report is written in Australian English; it should be noted that several words might differ in spelling from what the reader may be accustomed to using.

existed to assess the impact which changes to the built environment have had on patient health outcomes and staff satisfaction.

In order to justify the cost of hospital upgrade efforts, DHS sought persuasive evidence that investments in healthcare infrastructure are likely to yield substantial benefits in terms of efficiency of healthcare delivery, patient health outcomes, and staff satisfaction. Although obsolete facilities would be renovated regardless of a proven relationship between the built environment and patient health outcomes and staff satisfaction, DHS was interested in investigating this correlation to determine the efficacy of costly renovations.

Victoria's Department of Human Services presented the need for an assessment methodology created with the interests of Australian healthcare in mind. The goal of this project was to create such a methodology to enable empirical assessment of the impact of healthcare facility architecture on patient health outcomes and staff satisfaction, and to implement this methodology for the purpose of baseline data collection in two existing healthcare facilities. A framework for follow-up study was developed; this framework enables the collection of post-renovation data and allows for comparison to baseline data. Finally, the developed evaluation tools, baseline data, and assessment of pilot were transferred to DHS personnel via a user's manual, facilitating follow-up study completion. Completion of this study may provide DHS with empirical evidence corroborating the link between the built environment and its effects on patients and staff, substantiating decisions to fund healthcare refurbishment projects.

2 Literature Review

When patients enter into the care of a medical facility, their well-being depends upon more than just proper medical attention. This chapter will present research findings indicating that patient health outcomes and staff satisfaction can be directly related to aspects of the built environment. The physical setting of a healthcare facility and the quality of life that patients and staff experience are two of the most influential factors affecting their satisfaction and well-being. In addition, the built environment can have a large impact on the contraction or prevention of hospital-acquired infections. Recent research and published literature has provided a wealth of information on these topics.

2.1 EFFECTS OF BUILT ENVIRONMENT ON PATIENTS AND STAFF

According to Nielsen (2004), healthcare facilities are built for the medical treatment and recovery of the patient; therefore, patient health outcomes should be considered before aesthetics when redesigning a healthcare facility. He concludes that the most important aspect of a hospital is the exemplary support of patient needs. The International Federation of Hospital Engineering (2004) has also concluded that when designing a new building, it is critical that the environment and supporting activities fulfil the patients' needs.

It is widely agreed that the hospital environment that the patient is subject to can greatly influence recovery rates and final health outcomes. According to Rollins (2004), people in hospital experience increased stress levels that cause a multitude of psychological, physiological, and behavioural problems. Patients have shown such negative effects as anxiety, depression, and anger; they often exhibit increased blood pressure and reduced immune function as well. Other common issues include sleeplessness, aggressive outbursts, refusal to follow instructions, and drug or alcohol abuse (Rollins, 2004). Clearly, it is desirable to decrease stress factors in order to increase patient morale for the duration of his or her stay.

Nosocomial, or hospital-acquired, infection is an additional patient health issue affected by architectural design. Infections acquired during a hospital stay are detrimental to both patient health outcomes and staff satisfaction. Nosocomial infections often result in increased length of stay, readmissions, and decreased hospital efficiency.

The literature reviewed in this chapter indicates that improving the well-being of patients through renovations to the built environment will ultimately enhance the efficiency of a hospital, because patients content with their physical setting are likely to recover faster,

saving both space and money. The levels of required medication are also likely to decrease, further reducing costs. Satisfied, healthy patients positively influence the staff and their job satisfaction, giving healthcare facilities an atmosphere more conducive to healing.

The architectural environment influences patient and staff satisfaction, patient health outcomes, and the occurrence of nosocomial infection. Previous studies have noted the influence of certain environmental features on patient well-being and staff satisfaction. In this literature review, these factors will be examined to investigate the effects of the built environment on patient health outcomes and staff satisfaction.

2.1.1 Physical Setting

The architects and engineers who create the physical environment of hospital wards may be unaware of their impact on patient well-being. The quality and quantity of various design features, commonly looked at primarily from a structural standpoint, can improve both patient and staff satisfaction. As previously mentioned, patient well-being can influence wide-ranging aspects of hospital efficiency. Similarly, staff satisfaction affects hospital productivity. Therefore, it is wise for hospital personnel to examine relationships between individuals and their physical environment before renovating or constructing new healthcare facilities. Reviewing previously conducted studies constitutes one method of determining good practices for architectural design. This section reveals literature findings regarding various influential environmental elements.

The Presence and Placement of Windows. An acceptable environment can be created without the presence of windows in terms of lighting, ventilation, and energy conservation; however, in a healthcare environment, windows become important because of their influence on patient well-being. In addition to natural sunlight and fresh air, windows provide a link between patients and the outside world; they symbolise freedom and offer patients a distraction from the often gloomy hospital atmosphere, potentially improving recovery rates. Research indicates that the ability to connect with an external environment is especially important for patients confined to their beds with static surroundings (Ulrich, 1984).

Studies show that without a window, patients are far more likely to become disoriented and depressed, which may lead to increased anxiety levels and sleep deprivation. These emotional states are not conducive to patient well-being, and can inadvertently increase the length of hospital stays. Research suggests that the occurrence of organic delirium, characterised by a reduction in reasoning, orientation, and intellectual ability, is more than twice as high in patients staying in rooms without windows in the intensive care unit. The correlation between

patient well-being and the presence of windows demonstrates the importance of an outdoor view in hospital rooms. (Wilson & El Dorado, 1972)

There is noteworthy evidence supporting the fact that a window must be positioned properly in order to significantly impact the patient. Verderber (1986) notes that "insufficiently windowed spaces are characterised by sills high from the floor, distant from the viewer, or views obscured by nearby walls, screens, [and] furnishings" (p. 462). He also suggests that a hospital room with poorly positioned windows has the same effect on patient well-being as a room without windows, and that the most desirable views for a hospital patient are those including scenes of nature, people, or outdoor activity (Verderber, 1986). This preference is not surprising when considering that these views portray the basic elements of life and independence. The findings of Ulrich's experiment comparing and contrasting the well-being of patients with windows facing a brick wall and windows offering views of verdant trees indicates that the patients with a better view experience shorter hospital stays, receive fewer negative assessments in nursing reports, and require fewer narcotics during their stay (Ulrich, 1984). In order for healthcare facilities to improve quality of care, the placement of windows in hospital rooms may be equally as important as the presence of windows.

The orientation of windows may also influence the amount or quality of sunlight in hospital rooms. In a study by Beauchemin and Hayes (1996), patients with mild depression were discharged from psychiatric wards in less time when they occupied rooms which received brighter sunlight. This study may overemphasise the effects of sunlight because it deals with patients experiencing depression; however, it seems plausible that patients and staff would further benefit from the presence of sunlight since sunlight has been shown to elevate moods (Howarth & Hoffman, 1984). The effects of sunlight would presumably influence recovery times in a positive manner.

Despite the fact that many of these studies were specific to a particular type of healthcare facility or patient condition, all of the results agree that windows are a beneficial architectural feature in hospital rooms. The variety of studies that have been conducted simply reveal details that should be considered when designing bedrooms such as the positioning of a window, the view outside of a window, and the window's location with respect to the sun.

Single Versus Multiple Occupancy Rooms. Single occupancy rooms offer patients the comforts of privacy, quiet time, personal space, and control over their environment. Advantages of multiple occupancy rooms include companionship and variability. A hospital must consider economic feasibility as well as staff and patient preferences when designing a

healthcare facility. This task is convoluted by the complexities of patient preference that often depend on the patient's length of stay, hospitalising condition, and mental state.

Studies indicate that patients with dementia, comprising more than half of all long term care patients, spend more time in their rooms, have improved sleeping patterns, and engage in fewer conflicts with other patients when they are assigned a personal room (Morgan & Stewart, 1998). The improvements generated by private rooms can be explained by the continuity and familiarity that dementia patients develop in a private room and a decreased number of disruptions from staff attending to other roommates.

Another study conducted at a psychiatric ward suggests that the percentage of time patients spend in their bedrooms increases proportionally with the number of patients per room. The second half of the study observes the decrease in patient activity as room occupancy numbers increase (Nehrke, Morganti, Willrich, & Hulcka, 1979; Ittelson, Proshanksy, & Rivlin, 1970). Ittelson et al. (1970) observe that "the small room appears to provide the patient with wide freedom of choice in what he does in his room, while the large, multi-occupancy room acts to limit his freedom of choice and almost forces him into isolated passive behaviour" (pp. 268-269). Despite the inconsistencies in data regarding how much time is spent in bedrooms, both studies conclude that single occupancy rooms are a preferable option for these patients.

Spaeth and Angell (1968) analysed room preference of ophthalmic patients in a questionnaire format and discovered room preferences of these patients to be contradictory to those of dementia patients. Upon arrival at the hospital, nearly 86% of the patients expressed a preference for a multi-bed hospital room. It was also discovered that this inclination was intensified by a previous hospital experience, weakened by age, and was not influenced by economic status. Surprisingly, the preference for multiple occupancy rooms had no dependence upon the severity of the patient's ophthalmic condition. The conflicting findings begin to reveal differences in patient preferences and the many factors affecting them. One extremely influential factor appears to be the patient's mental state during his or her hospital stay. If a patient's hospitalising condition interferes with his or her ability to socialise, the additional distractions provided by a roommate may interfere with his or her recovery.

Other research has examined the relationship between bedroom privacy and the use of request-contingent pain medication. Dolce, Doleys, Raczynski, and Crocker (1985) indicate that "there is evidence to support a relationship between decreased environmental stimuli and increased sensitivity to pain" (p. 91). They conclude that decreasing the privacy of a hospital room encourages various environmental distractions and decreases requests for injectable narcotics. This study considered room preference and found it to have no profound influence on the results; the increase of request-contingent narcotics was associated with the room

design and not the patient's room preference (Dolce et al., 1985). These findings support the previous assumption that patients in their normal mental state benefit from additional room occupants, because added stimuli reduces the frequency of medication requests.

The implementation of private bedrooms could significantly impact hospital staff as well. In a study conducted by Morgan et al. (1998), staff members complained that single-bed rooms prevented them from monitoring more than one patient at a time and increased the distances between patients. Others in the healthcare field opposed to more single-bed rooms in wards agree that the increase in number of single-bed rooms results in longer travel distances for staff, increased shift sizes, and a reduction in quality of patient care. In addition, NHS Estates (2005) report that "single-bed rooms…are dangerously small for staff to work in. The staff are unable to care for patients without significant environmental considerations, and any bed transfers have to be performed in the corridor…there is a need to examine the single room provision from and ergonomic point of view, including eliciting the opinions of the staff who use them" (p. 53).

Although a ward comprised entirely of single-bed rooms is rare, the introduction of a higher proportion of these rooms has been acknowledged as a success in certain cases, with staff who were originally sceptical "being pleasantly surprised with how well [the redesigned facilities] operate" (NHS Estates, 2005, p. 50). NHS Estates (2005) found that a high percentage (85%) of single-bed rooms made for "easier management of healthcare accommodation under the current high occupancy levels," which translated into lower stress levels for staff (p. 50). Even if the patient outcomes associated with single-bed rooms are sometimes perceived as beneficial, staff satisfaction and the efficiency of the facility must also be considered.

Different results and opinions exist regarding the advantages of single-bed rooms. They undoubtedly provide the patient with increased privacy, but this form of isolation is sometimes considered a negative factor in a hospital environment in terms of staff efficiency. The choice to increase the number of single-bed rooms should be weighed against patient preference, staff satisfaction, and cost of construction before architectural changes are made.

Room Size and Layout. Many patients feel that large private rooms would provide them with the most comfort and privacy (Jones & Bullard, 1993). One visitor to a small single-bed hospital room observed, "there is no space for a person to eat or write in the room without really being forced to stay in bed" (Schwartz, 1982, p. 11). This comment suggests a direct relationship between room size and satisfaction. Logically, increasing comfort and privacy could potentially eliminate unnecessary anxiety and improve recovery times.

Larger rooms might also encourage friends and family to visit more frequently. If there was enough space, visitors would feel more comfortable spending the night at the hospital. The presence of friends and family could provide patients with additional support and comfort and aid in reducing unnecessary stress.

In psychiatric wards, increasing room size seems to have no effect on the amount of time spent in rooms (Ittelson et al., 1970). One possible explanation for this trend is that psychiatric patients are allowed to leave their rooms to go to other living areas. When one is confined to a bedroom, room size may be a more significant variable. Overall, there is speculation that larger rooms will benefit patient outcome, but no apparent evidence exists. Until further research has been completed, increasing the size of rooms during a hospital redesign should be a secondary concern that is only considered when economically feasible.

The satisfaction of staff members can also be affected by the size of spaces in their primary working environment, including patient rooms and the ward nurse base. According to medical staff of Bristol's Royal Hospital for Children who were surveyed by Redshaw et al. (2004), patient room size was often viewed as "too small for present needs" (p. 26). Such spatial constraints negatively affect staff members' ability to deliver services, and can result in decreased staff satisfaction. Redshaw et al. (2004) note that staff members found nurse base location within facilities were appropriate. However, inefficient utilisation of this ward space can create a situation of cramped or cluttered working conditions for facility staff, decreasing their satisfaction (Redshaw, Scrase, Johnson, Begen, & Greene, 2004).

When considering the overall layout of a particular ward in terms of staff satisfaction, one must be aware of total distance across the ward and the partitioning of specialty areas. Redshaw et al. (2004) report that a larger ward, although affording a greater proportion of space for security areas and staff amenities, creates a "larger, less intimate hospital" where greater distances between rooms and office areas "[make] interaction more difficult,…[zone] off specialty areas…and [make] wards more difficult to staff" (p. 29). Additionally, the stresses of multitasking and lengthy travel distances are compounded by ward type. It was readily apparent to Redshaw et al. (2004) that an expansive ward with great distances between individual rooms and the nurse base is both unsuitable and unsafe for a scenario in which urgent care is necessary (p. 35). Staff satisfaction is significantly affected by both the size of the ward and the layout of its rooms in relation to a nurse base. Generally, as ward space increases, staff satisfaction will decrease due to increased travelling distances and inability to monitor multiple patients simultaneously.

Personal Space. People are naturally protective of their property and the personal space surrounding them. The personal significance of these factors is heightened by a hospital environment. Patients' physical and mental abilities are often compromised, and doctors or nurses must invade their personal space in order to ensure proper care. These invasions have the potential to increase anxiety; however, they are often anticipated in a hospital environment, so this intrusion of space may not be perceived in such a negative manner.

An extensive study conducted at three hospitals found that manipulation of personal belongings increased patient anxiety, but patients were unresponsive to invasions of their personal space (Allekian, 1973). The type of healthcare facility or length of stay did not have any impact on these findings. The results are not surprising when considering that invasion of personal space to perform medical procedures is vital for the patient's recovery, but manipulation of personal belongings is unnecessary and is found to be offensive. Patients in this particular study were even responsive to changes in lighting conditions without their consent (Allekian, 1973).

The differences between personal space and territorial space must be considered with respect to their relationship to architecture. Patients in individual, private rooms would obviously have more space to call their own. These patients would not suffer from the increased anxiety of protecting belongings from other roommates. Personal space is another factor to consider when weighing the advantages and disadvantages of single and multi-occupancy bedrooms.

The personal space of staff members should also be taken into consideration when evaluating a healthcare facility. The at-work privacy level of staff members depends upon their ability to remove themselves from the medical environment to "get away from patients and [their] families" (Redshaw et al., 2004, p. 31) while taking a break from work, particularly at meal times. Another important component of staff privacy is the security of personal belongings. A hospital is a high-traffic area; thus, a great number of individuals could have access to unguarded personal items over the course of the day. Increased area for the secure storage of personal effects allows a staff member to safely store all of his or her items (Redshaw et al., 2004). Privacy in the healthcare facility can allow staff members to be more satisfied with their work environment.

Aesthetic Appeal. Different intensities of colour can provoke a variety of feelings, and the colour schemes used in hospitals are an important environmental variable in recovery. Black represents the absence of light and often creates a feeling of depression or isolation. White, alternatively, conveys the presence of bright light, a colour safe to use in a hospital

environment but also plain and relatively uninteresting. Pale, cool colours have the ability to transfer peaceful, tranquil feelings, and bright, warm colours are energising (Torrice, 1989).

Zagon (1992) points out the importance of recognising the relationship between colours and certain medical diseases. She claims that it would be unwise to put a patient with jaundice in a yellow room, as this colour could be a constant reminder of his or her condition. Similarly, patients with depression would benefit from warm colours, while cool colours would better suit nervous patients. In a study conducted by Zagon (1992), she found that the majority of people believe blue to be the most effective colour in enhancing the healing process. She explains, "as the nature symbol of the sky and ocean, blue is…spiritual, meditative, peaceful, communicative, and creative" (p. 144). This relaxing description generates a powerful argument for the use of this colour; however, the importance of variety must also be considered. The attitude of patients often changes throughout the duration of their stay in the hospital. In order to appease a diverse group of patients, Zagon (1992) recommends using the full colour spectrum, allowing patients to tailor their focus to the appropriate colours.

In addition to colour, artwork may have mood altering implications which could potentially improve patient recovery and staff satisfaction. It is important to note that artwork itself is a very efficient vehicle for utilising colour. In the past, hospitals have displayed artwork containing religious scenes, hospital procedures, or grateful patients; nevertheless, these are not necessarily the most effective visual aids in improving patient well-being. As with colour, artwork has the capacity to generate a plethora of responses depending upon the patient. Research suggests that the most appropriate artwork selection should serve to eliminate anxiety of both patients and staff. Maxion (1989) proposes watercolour paintings and advises against artwork with sharp angles, because "we are relaxed and comfortable with curves" (p. 88). Ulrich finds abstract paintings to have negative connotations in an environmental setting, but others attribute his findings to the lack of colour in many of these paintings (Zagon, 1992).

With the large range of patient demands and preferences, some hospitals allow patients to choose the artwork for their hospital room, either by offering a variety of artwork for the walls or allowing patients to bring in their own art (Torrice, 1989). This alternative method, catering to each individual patient's preference, provides patients with control and individualisation of their environment. For long term care patients, it is a particularly attractive option.

Art can be a large financial investment for healthcare facilities, but it also has significant influences on patient and staff well-being. Any environmental variable with such mood altering potential must be seriously considered in a hospital setting. If a properly decorated

facility lowers stress levels and improves patient well-being, the average length of patient stay would be expected to decrease, making artwork a wise financial investment for healthcare facilities.

Lighting. Companies such as Whitecroft Lighting have recognised the importance of using lighting to create a "positive recovery environment for patients" (A bright idea, 2004, p. 37). Two considerations are significant when choosing to replace existing lighting with newer fixtures, which promote both the aesthetic appeal of a facility and the health of the patient: lighting control (direction, intensity, and levels of the lighting), and energy consumption level. The first is a human issue that impacts both patients and staff alike. The second, a financial issue, affects the economic situation of the healthcare facility (Barnitt, 2001).

Three elements are important to the human aspect of hospital lighting design: reduction of overhead glare; allowance for personal control; and adequate lighting for staff needs (examination and safety). Glare reduction can be accomplished through the installation of indirect lighting (known as uplifting light) and diffused light sources (Barnitt, 2001). Modern lighting manufacturers allow patient control with products such as individual modular switches governing intensity levels and direction (A bright idea, 2004). Clinical areas require a balance between intense examination light and comfortable patient light. A common example is seen in the examination rooms of a dentist's office, where the dentist uses a singular high-intensity light sparingly, and the dental hygienist utilises softer, indirect lighting. Additionally, lighting used in examination areas must possess the ability to reveal "true colour rendition," allowing professionals to determine subtle differences in colour (Barnitt, 2001, p. 39).

Due to the reflective nature of newer vinyl safety flooring, extra attention must be given to avoid overhead glare within the corridors of a healthcare facility. Visibility is a necessity here, but it does not need to come at the cost of aesthetic appeal. Uplifting light, as previously discussed, can be employed via wall-mounted fixtures, creating both a "sense of liveliness" and the optical illusion of expanded hallway width (Barnitt, 2001, 39).

Architect and lighting designer Simeonova (2004) verifies that "research findings support the idea that the built environment influences patient outcomes, staff satisfaction, and cost-efficiency." She continues her explanation, stressing the importance of a facility's ability to attract and retain patients. Simeonova (2004) points out that since 80% of all information gathered about one's surroundings is accomplished through vision, "lighting is of vital importance to what the patient sees and the opinions he or she formulates concerning the healthcare environment" (p. 1).

In terms of psychological wellness, lighting holds the potential to promote a positive environment when implemented in conjunction with other visual and auditory stimuli. A hospital's usage of light and lighting colour can provide a recovering person with a "continuous sequence of occurring changes in the environment that stimulates the brain" (Simeonova, 2004, p. 1). Inadequately lit facilities promote a static environment in which a patient may experience the same sensory influences for extended periods of time. Such patients are "deprived of sensory experiences," according to design author Jain Malkin (Simeonova, 2004, p. 1). Static lighting detracts from the recovery process, creating a "dead environment" in which healing appears slowed to the patient (Simeonova, 2004, p. 1).

Modifications to lighting do not necessarily need to be extensive or costly. Walsh (2001) evaluated the lighting of neonatal intensive care units by augmenting the existing lighting with three individual halogen spotlights above each bed space. The existing lights were used at the discretion of the staff, and individual halogens that emitted both light and heat were utilised for individual care giving and examination. Although a relatively high level of intensity is necessary for skin colour examination, research concerning neonatal development of the retina reveals the need for softer, intermittent levels; a balance of intensity and control is necessary. In the study by Walsh (2001), 91% of the hospital staff found the overall lighting level to be reduced, 59% stating that they felt the overall care of the babies had been improved, and 61% stating that the new lighting was beneficial to the caretakers themselves. The economic impact of the lighting improvements was minimal ($3,200 for six beds). Although the psychological impacts of the lighting is difficult to discern, the staff satisfaction ratings and necessity for soft light due to eye development in newborns serves to support such an architectural improvement (Walsh, 2001).

Interior and exterior lighting constitute 15-20% of a hospital's total energy consumption. Barnitt (2001) determined that "modern electronics used in conjunction with lighting management systems are able to bring about energy reductions of up to 50%" (p. 39). Such reductions can be realised through a policy of necessity (use lights only when they are needed), intelligent lighting schemes (overhead lighting during the day and wall lighting at night), and the installation of daylight sensors and motion detectors in low traffic areas (Barnitt, 2001).

Floor Surfaces. If an individual in need of medical attention is taken into the care of a healthcare facility, one of the last thoughts to cross his or her mind is a careless slip on the floor leading to an injury. Although patients might overlook the significance of flooring, healthcare administrators and designers must consider this architectural element. Hospitals do

not have the luxury of designing for the average healthy individual. Planning and engineering must take into account individuals who are physically handicapped, visually impaired, and/or in a weakened state. These individuals are prime candidates for a flooring-related accident. From 1999-2000, statistics of the Health and Safety Executive of Great Britain enumerate some 858 major injuries as a result of slips and falls in healthcare facilities, along with some 2,083 three-day accidents (Robinson, 2001). Since the healthcare facility may be liable for on-site patient injuries, major litigation expenses can arise. According to Robinson (2001), poor floor coverings result in "the highest quantity of litigation claims in health service,…accounting for an annual cost of approximately 15 million British pounds" (p. 33).

Regardless of the type and quality of flooring installed within a facility, there will undoubtedly be some form of maintenance to be performed at various intervals to reduce wear and increase product life expectancy. However, the costs associated with flooring maintenance are great. Tarkett, a modern safety flooring company in the United States, has taken this problem to its designers and proposed a solution which has earned it the distinction of being one of the first companies awarded a Building Research Establishment (BRE) Certification for vinyl floor coverings. Tarkett's efforts to increase flooring sustainability have made renovation and replacement projects much more feasible in an economic sense (Skimming the surface, 2004).

Not only do newer safety floorings protect against slippage, but they also have the ability to dissipate the static charges accumulated as patient and faculty member traverse the facility. Such charges are detrimental to some electronic equipment. Additionally, the same floor coverings now possess internal antibacterial agents without dirt traps. This flooring can be found within healthcare kitchens and hallways throughout Great Britain (Robinson, 2001).

Replacing the flooring of a healthcare facility is obviously expensive. Modern economic trends in the field of healthcare require the procurement of funds for extensive projects through a private financial initiative (PFI), a universal means by which a wide range of public projects are privately funded. According to Sensecall (2004), marketing manager for Armstrong Floor Coverings and the United Kingdom's National Audit Office, "there have been substantial improvements in PFI…with far fewer projects exceeding their budgets and going over their deadlines" (p. 35). The idea of time-value of money has been central to the decision to refurbish or replace floor coverings, especially with the long-term implications that a flooring project carries. On average, the life-cycle of a flooring contract extends 25 years. Accordingly, entering into a contract with a manufacturer requires the assurance that such a company will be in existence and their product will be able to withstand wear through constant use (Sensecall, 2004).

For those presented with the decision of whether on not to replace or renovate, the pros and cons of flooring must be weighed and evaluated from both human and economic standpoints. The cost of litigation resulting from flooring-related injuries must be compared to the costs of purchase, installation, and maintenance. Regardless of the economic situation of the institution, Robinson (2001) assures that such flooring improvements "reduce the risk of accidents through slipping on spillages of various liquids, as well as offering hygiene and static protection" (p. 33).

2.1.2 Quality of Life

Knowledgeable healthcare professionals and friendly support staff directly influence patients' physical well-being; however, these persons are not the sole factor in determining quality of life. A well-kept environment that makes the atmosphere more comfortable has the ability to foster what the patient may deem a high quality of life during his or her hospital stay. Perry (2003) found that "the quality of both the treatment environment and the non-clinical environment contribute to patient health outcome," and noted that "the overall environment…needs to be clean, tidy, well-maintained, and well set out" (p. 36). Elements that make patients more comfortable or content about their health will result in decreased levels of stress and increased confidence in their bodies' ability to recover.

The overall quality of the hospital environment has been shown to affect many aspects of a patient's psychological and physical well-being. Scientific research has shown a link between poor health and poor physical environments. Dilani (2001) believes that the environmental factors which cause stress should be identified, removed, and replaced with more "psychosocially supportive" elements. Environmental psychologists have developed five broad areas that they believe contribute to decreasing stress and increasing the quality of life during hospital stays. Scalise (2004) and Berry et al. (2004) report these areas as: patient control of his or her environment, positive distractions or pleasant diversions, a connection to nature, social support, and the elimination of environmental stressors.

Patient Control of Environment. According to Bilchik (2002), "since the earliest evolutionary phases of human life, we have had a visceral, survivalist need to be sensitive and responsive to our surroundings" (p. 19). This instinct explains why patients desire to have control over their environment. Research has shown that this control reduces stress in all environments – not only in the hospital. Patients who can control the factors of their hospital room will experience less stress and are more likely to heal in shorter periods of time (Bilchik, 2002). Dilani (2001) states that "people who do not have control over their

environment often suffer from various kinds of stress" (p. 24). In addition, Berry et al. (2004) suggest that "a sense of control is important for feelings of self-esteem and security" (p. 8).

In studies by Pangrazio (2003) and Bilchik (2002), patients indicated that they wish to have control over factors such as temperature, lighting, timing and content of meals, entertainment, décor, artwork, and furniture. The ability to control some of these items can be placed at the patient's bedside in order to facilitate manipulation of their environment. Remote controls can be provided for lighting, temperature, access to entertainment devices (TV, music, Internet, etc.), nurse assistance, and even windows and window blinds (Scalise, 2004). Verderber (2000) comments on windows, finding that the ability to open or close blinds and windows, or to move toward or away from the window contributes to an increased sense of control.

One way to provide patients with increased privacy is to place them in single-bed rooms. Such arrangements effectively reduce the amount of time caregivers spend in the room and prevent disruptions caused by the visitors of a roommate. In addition, single-patient rooms decrease the frequency with which patients need to be moved to other hospital locations, which according to Pangrazio (2003) reduces stress on the patient and also decreases the risk of mishaps such as falls. Patients' ability to control their environment is closely related to the degree of privacy they experience. Scalise (2004) notes that as the amount of privacy increases, patients feel more control over their health outcomes. Therefore, allowing patients to control their living space is quite desirable with respect to their well-being.

Positive Distractions. A lack of positive stimulation or pleasant diversion can be quite depressing for patients. According to Bilchik (2002), "distractions can make people forget their problems" (p. 20). Pleasant diversions such as artwork, music, televisions, aquariums, and computers with Internet access provide stimulation to patients, engaging them in activities that can contribute to their well-being. Berry et al. (2004) argue that the main idea behind providing stimulating factors is to elevate patient mood, leading to decreased preoccupation with illness or associated pain.

Many facilities provide bedside access to these diversions. A boom arm designed to swing over to the patient can include controls for television and music and a telephone (Perry, 2003). In a few of the most modern facilities, computers are also located bedside, providing patients with access to the Internet. Having these digital devices available to patients can make them feel much more comfortable away from home.

Dilani (2001) and Scalise (2004) both present convincing arguments for music and sound inside the hospital room. The stimulation which music can provide has profound effects on emotional health. In some cases, soothing nature sounds can be selected to put the patient at ease. Dilani (2001) argues that music is not restricted to the patient's room, but can be offered in a range of settings and rooms. He states, "music can be used during a variety of treatments and operations in the hospital, for example during orthopaedic surgery, X-ray and in waiting rooms and in the main entrance of many kinds of facilities in order to reduce stress" (p. 25).

By providing pleasant diversions, healthcare facilities are helping to remove suffering from patient minds. These distractions are achieved primarily through entertainment media such as music, television, or computers. Other forms of distractions include artwork and nature sounds. Studies show that patients have healed more quickly when they are not consumed by thoughts of their illness.

Connection to Nature. Nature has a significant impact on both the healing process and patient quality of life. Like the diversions mentioned above, a connection to the natural world aids healing by reducing stress. A direct contact with nature can be established by means of outdoor therapy, sunlight, water, and exercise (Verderber, 2000). "Seeing the sky or feeling the sun on your skin can literally make you feel better," claim Berry et al. (2004, p. 8).

Access to nature has also been shown to reduce the amount of medication required and decrease the length of recovery time. Dilani (2001) found that exposure to nature can reduce blood pressure and ease pain in addition to positively affecting a person's emotions. A study conducted in Sweden in the mid-1980s reported improved recovery rates for patients located in rooms overlooking nature (Verderber, 2000). The author noted that patients took fewer analgesics, had shorter post-operative stays, and had fewer negative comments in their medical notes than patients without views of nature.

The Architects Design Partnership (ADP) (2004) argues that a connection between bedrooms and gardens that encourages bird life should be made whenever possible. The view of animals can give patients a feeling of the life beyond their room and provide aid for recovery. Many buildings designed by ADP provide large bedroom windows facing out over grounds landscaped to encourage wildlife. The rooms often have an outdoor sitting area to allow patients and visitors to enjoy the restorative effect of being surrounded by nature. Rollins (2004) agrees that outdoor gardens with seating allow both patients and their visitors to enjoy the soothing natural distraction.

When the location of construction cannot provide views of nature, many hospitals resort to the transformation of interior space into healing gardens (Berry et al., 2004). At the Bronson Methodist Hospital in Kalamazoo, Michigan, USA, Scalise (2004) observed a cardiac patient who spent time in both older and newer buildings. This individual attested to the effect of nature on his well-being. "[He has] watched the leaves bud outside the window…it lets [his] mind wander." He also appreciated the indoor garden that is located in the lobby. "It [gave] a friendly feeling…it's not all iodine and alcohol" (pp. 50-51). Such testimony suggests that even the slightest exposure to nature helps to better moods and relieve the mind from thoughts of illness affecting the rest of the body.

Social Support. Social support is another factor affecting the quality of life experienced by a hospital patient. Interaction with family and friends can help people feel better about their situation and recover more quickly. Health psychologists have found that those persons who receive a high level of social support experience less stress and achieve higher levels of wellness (Berry et al., 2004). In addition to providing the patient with the comfort of family and friends, visitors who choose to spend time in the room learn more about the patient's condition. Scalise (2004) believes these visitors have the opportunity to learn about the patient's treatment and are useful resources for the patient upon discharge.

Scalise (2004) also argues that in order to increase social support, patient rooms should have space for visitors to comfortably stay for a prolonged period of time. The placement of furniture and room layouts can have a direct influence upon social interaction in healthcare facilities. If furniture is heavy or immovable, interactions with family and friends can be severely limited. According to Berry et al. (2004), lightweight, moveable furniture will encourage a friendly, social environment for visitors to interact with the patient.

Having family and friends in the same room as the patient can make patients feel more comfortable and as if they are at home. This social support places patients at ease and can help improve their recovery rate. For this reason, it is important that healthcare facilities design waiting rooms and patient rooms to be visitor-friendly and well accommodating.

Hospital staff members are influenced by their degree of social interaction as well. Redshaw et al. (2004) find the ability of staff members to socialise important to overall employee satisfaction. Surveyed individuals felt that " a common meeting area…[located at a] central point for medical staff from different specialties to meet informally" was one of the most significant issues for those making a hospital their place of work (Redshaw et al., 2004, p. 29). A facility lacking communal areas that enable detachment from the rigors of work may

find its staff members falling into small cliques based on medical specialty, which is regarded as undesirable (Redshaw et al., 2004).

Elimination of Environmental Stressors. Without control of the environment, positive distractions, connection to nature, and social support, stress could easily begin to overcome a patient. However, these are not the only factors contributing to quality of life; there are other environmental causes of stress. If these elements cannot be controlled by the patient and are difficult to ignore, stress levels will inevitably increase. Berry et al. (2004) has gone so far as to claim that the largest, most prevalent of these negative distractions is noise.

Noise, in itself, is an unavoidable aspect of any healthcare facility. Equipment that monitors the status of patients alerts the caretakers to a change in vital rhythms or cyclic processes, and these alerts often take the form of auditory warnings and messages. Staley (2004) declares that bothersome and repetitious noises from inanimate objects are particularly aggravating to patients experiencing pain. Management of sound is extremely difficult; as stated by Mazer (2003), it constitutes the "least controllable and most pervasive… of all environment stressors in the clinical setting" (p. 16). Haigh (2001) suggests that noise within the healthcare environment "can increase the pain that a postoperative patient will experience and that physiological and biochemical response of both of these, coupled with the insomnia that is produced…can slow the wound healing process" (p. 29).

Sound can have serious effects within the confines of a care unit offering the most extreme of health services, such as a critical care unit (CCR) or an intensive care unit (ICU). Topf (1993) demonstrated that noise-induced sleep deprivation, one of the effects of excessive noise levels, may affect patient energy levels, recuperation rates, and cognitive levels. Deprivation of certain sleep stages can result in immunosuppression, which is a major hindrance to the healing process. Topf (1993) reports that "considerable empirical evidence supports the claim that advances in hospital technology have led to increased CCU sound levels and, consequently, poorer patient sleep" (p. 252).

Specific independent CCU sound studies showed the average background sound level in healthcare facilities to be in excess of the 45 dB maximum recommended by the U.S. Environmental Protection Agency, with individual sounds reaching levels of 78 dB (Topf, 1993). Despite such evidence, the correlation between excess noise and poorer sleep patterns was not made until later studies were carried out. Topf (1993) found that 16 of 35 female volunteers experienced poorer sleep in noisier environments. Reduced sleep quality resulted in confusion, suspiciousness, withdrawal, and poorer recollection of complex information on the part of the test subject. The study showed that persons subjected to high levels of noise

experience poorer sleep and higher amounts of undesirable rapid-eye movement (REM) sleep. Topf's (1993) conclusions displayed the need for "attention to acoustic details to reduce sound levels" (p. 257). In order to achieve quieter CCUs, Topf suggested an expansion of the role of the nurse, who should "act as an environmental activist responsible for abatement of ambient stressors such as CCU sounds" (p. 257). She also called for the control of noise variables, along with "collaboration between hospital administration and architecture planners" in attempts to create a healing environment (p. 257).

Noise and its correlation to the healing process is not a new topic of concern. A 1992 study performed by McCarthy revealed the effects of short-term exposure to excessive noise levels on the wound healing process (Haigh, 2001). A group of rats were subjected to 24 hours of loud rock music. Certain chemicals in the blood that facilitate the healing processes were altered in response to the music. The control group, however, in a normal noise environment, experienced no such change. Although the study dealt with animals and raised the issue of human applicability, hypotheses were formed stating that noise levels, even as low as 64 dB, contributed to a delay in wound healing and lengthened overall hospital stay (Haigh, 2001).

Mazer (2003) suggests evaluating noise levels in healthcare facilities through per-ward assessments that consider background noises. A constant noise level slowly becomes indistinguishable to the patient or staff member, and outlying noise levels can be isolated and assessed. Through background noise assessment, Mazer (2003) established a means by which "the optimum continuous volume level and the maximum level for incidental sounds can be established" on a per-ward basis (p. 15). Since background noises can be unique to a certain ward, these volume levels can vary significantly from ward-to-ward.

A value cannot be placed upon a sound's ability to convey importance or readiness, severity or alarm. It is for this reason that intrusive noise cannot be eliminated from the healthcare environment. However, with numerous studies connecting noise to healthy sleep and patient well-being, measures taken to reduce average facility decibel levels are likely to be beneficial to patients and staff alike. Mazer's (2003) idea of noise assessment and Topf's (1993) analysis of the CCU unit show the importance of attacking the noise-reduction problem on an individual-room/ward basis.

2.1.3 Nosocomial Infection

The prevention and regulation of hospital-acquired, or nosocomial, infections are among the central concerns of the healthcare industry. Potentially life-threatening and antibiotic-resistant pathogens present a great risk to both patients and staff upon infection and colonisation. Therefore, Burke (2003) asserts that healthcare resources must be allocated toward the

prevention of these infections, which he claims are responsible for complications in ten percent of hospital patients. However, Ulrich, Zimring, Quan, Joseph, and Choudhary (2004) claim that due to the complex nature of infection origin, transmission, and treatment, variables affecting hospital-acquired infections are extremely difficult to study on a singular level in a controlled setting.

According to Ann Noble Architects [ANA] (2003), general awareness regarding infection control measures has recently increased due to realisation of the serious risk of pathogens becoming resistant to antibiotics. Thus, the usage of antimicrobial solutions has begun to be regulated, and healthcare administration must look to other measures of infection control. One such alternative measure is examination and renovation of the architecture of the facility. ANA (2003) illustrates that this process can be carried out by teams of expert consultants that are able to review pertinent literature in their respective field, draw conclusions, and make recommendations to healthcare administration based on their findings. This team should be responsible for space planning, layout, environmental services, and maintenance potential of a new or renovated facility. Another factor to be taken into consideration is the minimal disruption of clinical activities during the renovation process. In other words, ANA (2003) states, the team must "create an effective synthesis of all criteria and requirements" (p. 11).

A comprehensive and systematic review of pertinent literature by Dettenkofer et al. (2004) revealed numerous though discouraging insights about the correlations between hospital architecture and nosocomial infection. The emphasis of their article was that no randomised, controlled studies of the relationship between the built environment and infection rates have been performed, so the validity of the possibly subjective and biased data is questioned. Dettenkofer et al. (2004) recognised the possibility that this lack of convincing evidence may have been a result of the "multifactorial nature of these infections" (p. 24). The authors suggest that a reduction of infection incidence will be seen if certain measures, such as construction of additional isolation rooms, single-bed rooms, and visible handwash facilities, are implemented.

Despite the increased up-front cost of such renovations, significant savings can result from lower rates of infections. A decreased incidence of nosocomial infection will result in a beneficial effect that is felt on many levels, from the patient to the administration. Patient hospital stays will be shorter on average, and subsequently, less medication will be used and morbidity/mortality statistics will be reduced (Berry et al., 2004; O'Connell & Humphreys, 2000; Bergogne-Berezin, 1999, pp. 63-64).

Single-Bed Rooms. Perhaps one of the most logical means by which to reduce the incidence of nosocomial infection is to increase the number of single-bed rooms, thereby minimising the contact one patient has with other patients. According to Berry et al. (2004), "infections in multi-bed rooms are more likely because of the cross-transmission of microbial pathogens between patients" (p. 9). The modern medical centre has high potential for this transmission to occur, and it is up to the administration to integrate a helpful design to reduce this risk.

The implementation of single-bed rooms in healthcare facilities has the potential to decrease both airborne and contact transmission of nosocomial infection. Reservoirs, or surfaces of contamination in the hospital surroundings where infectious agents can grow in large numbers, are a major means by which infection is spread. The proposed prevention mechanism is based on this concept of reservoirs. Ulrich et al. (2004) reported that inanimate objects such as tables, curtains, computer keyboards, medical equipment buttons, door handles, bed rails, furniture, and countertops are major reservoirs for these microbes. The presence of only one patient per room would minimise the risk of cross-contamination of these reservoir surfaces. Another prospective benefit of additional single-bed rooms is patient transfer reduction. Berry et al. (2004) found that the occurrence of patient transfer due to roommate incompatibility is eliminated, thereby decreasing associated safety hazards that include medical error and spread of the pathogenic reservoir to the central hallways and other rooms of the hospital.

The need for single-bed rooms is even stronger in both adult and neonatal special care units, including intensive care units (ICUs). Jernigan, Titus, Groschel, Getchell-White, and Farr (1996) observed that the risk of nosocomial infection is decreased by isolation in single-bed rooms in the neonatal intensive care unit, but is increased when there is spatial proximity to an infected patient and shared exposure among staff members. Ulrich et al. (2004) noted that in cases of life-threatening epidemic, such as Severe Acute Respiratory Syndrome (SARS), of which 75% of cases were nosocomial, single-bed rooms with appropriate ventilation are essential for the treatment and confinement of pathogens (p. 10).

Single-bed rooms are also easier to clean after a patient has been discharged. When a patient is discharged from a multi-bed room, a greater number of surfaces exist that may act as reservoirs for pathogens (Ulrich et al., 2004). Experimentation by Boyce, Potter-Bynoe, Chenevert, and King (1997) found that methicillin-resistant *Staphylococcus aureus* (MRSA) was present on the gloves of forty-two percent of nurses who never came in direct contact with an MRSA patient, but became infected through unknowing exposure to contaminated surfaces. It was also determined that in the rooms of MRSA patients, twenty-seven percent of sampled surfaces were contaminated with MRSA. Statistics of this nature should alert

healthcare professionals and patients to the potential danger of these easily transmissible infections.

In addition to increasing privacy, single-bed rooms can reduce the incidence of nosocomial infection. Rollins (2004) reports, "the rate of hospital-acquired infection decreased eleven percent in new patient pavilions…[featuring] private rooms and specially located sinks" (p. 338). Sandrick (2002) attributes this significant reduction to elimination of patient transfers due to roommate incompatibility, increased ease of cleaning to prevent pathogenic reservoirs, and minimised risk of cross-infection between patients. It is essential for healthcare administration to take into account patient preference, financial implications, and hospital efficiency with respect to nosocomial infection rate during the hospital redevelopment process.

Ventilation Systems and Air Quality. Another seemingly intuitive method of airborne nosocomial infection reduction is the implementation of proper ventilation and the maintenance of air quality throughout the healthcare facility. Air quality parameters that have been investigated include type of air filter (i.e. High Efficiency Particulate Air [HEPA]), airflow direction and pressure, humidity, and ventilation system cleaning and maintenance (Ulrich et al., 2004). Proper ventilation ensures filtration of many pathogens from the hospital air and effectively isolates infected patients. Bergogne-Berezin (1999) insists that careful monitoring and maintenance of air conditioning, heating, humidifier, and filtration systems is required to effectively prevent nosocomial infection and colonisation.

Stoner, Smathers, Hyman, Clapp and Duncan (1982) state that unhealthy conditions in hospitals can be partially attributed to an "incubator effect," in which pathogens are able to remain in the air of a closed facility, due to a lack of reliability and effectiveness in natural ventilation. Mechanical circulation, on the other hand, is designed to efficiently "remove a contaminant, heat or cool a space, or to supply make-up air" (p. 95). This operation serves a dual purpose: to protect a patient from potentially contaminated air, and to protect the air supply of the hospital from an infected patient or reservoir.

A ventilation system must be designed so that patient safety is emphasised. Numerous studies have shown that ventilation is a key to understanding and preventing nosocomial infection, and many instances have been noted in which an infection of unknown aetiology was discovered to originate in the ventilation or humidifier systems of the hospital (Kyrakides et al., 1976; Fridkin et al., 1996; Cotterill, Evans, & Fraise, 1996). A major culprit in airborne nosocomial infection is *Aspergillus*, which is usually associated with faulty or unsanitary ventilation systems (Humphreys et al., 1991; Kyrakides et al., 1976). In order to reduce the

risk of easily inhaled *Aspergillus* and other nosocomial infections associated with such ineffective ventilation systems, Noskin and Peterson (2001) present the need for industry-wide evidence and standardisation in terms of filtration, pressure regulation, and air quality.

In the case of ICUs, specific standards associated with airflow and ventilation have been established. O'Connell and Humphreys (2000) recommend that air conditioning be adjustable from 16-27°C, humidity from 30-60%, and ventilation pressure from positive to negative. The ventilation system must also be adjustable from six to fifteen air exchanges per hour, and the filtration must be equipped to eliminate all particles over five µm.

Studies show HEPA filters to be extremely effective in the prevention of nosocomial infection in immunocompromised patients, but only in conjunction with other measures, including rigorous cleaning procedures, sealed windows, and improved infection control barriers (Humphreys et al., 1991; Noskin & Peterson, 2001). Loo et al. (1996) suggest the implementation of wall-mounted portable HEPA filter air purifier units as a means of infection control; these serve to remove at least 99.97% of 0.3 µm particles and all fungal spores. However, these units operate by diluting the room with filtered air, not by filtration of the incoming air supply. Increased isolation and decreased air contamination is achieved in rooms with laminar airflow, in which a slow, steady velocity of air is blown into the room (Ulrich et al., 2004). Despite its usefulness, laminar airflow is difficult to attain because it is easily disrupted by any object or vent. This model, in conjunction with HEPA filtration, although expensive, is theoretically the most effective means by which to prevent airborne transmission of infection.

Air quality and ventilation are essential factors for the control of nosocomial infection and proper measures must be implemented to fully utilise their preventative potential. HEPA filtration, isolation of high-risk patients, and control of airborne pathogens are necessary to create the proper barriers among patients and staff.

Handwashing Facilities. Despite the readily apparent concept that frequent handwashing prevents transmission of infections, many healthcare professionals fail to comply with set sanitary procedures. Ulrich et al. (2004) find this lack of compliance particularly common in understaffed wards with high patient-occupancy. O'Connell and Humphreys (2000) attribute a low rate of staff compliance to a low number of basins, inaccessible locations, and poor design. Noskin and Peterson (2001) suggest carefully planning the placement and accessibility of sinks in order to encourage frequent use; staff compliance can be improved through the introduction of hands-free sink, soap, and paper towel locations near the entrance of patient rooms. O'Connell and Humphreys (2000) present another relevant characteristic of

such sinks – adequate depth, which ensures a reduction of splashing of pathogens that may be residing in the drain of the sink.

A variable in the application of these findings is the method of handwashing. The traditional soap and water technique is acceptable, but the usage of alcohol rubs is becoming increasingly popular. These alcohol rubs are easy to use, require no towels, and are more effective against bacteria and viruses than soap and water (Berry et al., 2004). Studies by Pittet, Mourouga, and Perneger (1999) and Berry et al. (2004) demonstrate that these alcohol rubs are most effective in bringing about an increase in staff compliance when dispensers and posters are placed within clear view of patient rooms.

Contrary to the results of Noskin and Peterson (2001), other researchers have found that educational programs, dispensers at patient room entrances, and automated sinks do not significantly increase staff compliance with handwashing procedures (Ulrich et al., 2004; Muto, Sistrom, & Farr, 2000; Larson et al., 1991). Ulrich et al. (2004) claim it is unclear "how much of the effectiveness in terms of increased handwashing or reduced infection rates can be attributed to the installation of more numerous and/or accessible sinks and alcohol gel dispensers" (p. 10) and present the need for extensive studies defining accessibility and detailing staff patterns and habits.

Environmental Surfaces: Flooring, Walls, Countertops, and Ceilings. Generally, the environmental surfaces of a healthcare facility should be durable and easy to clean. Ann Noble Architects (2003) report that it is essential to avoid difficult-to-clean spaces and surfaces when designing a healthcare facility. This principle can be implemented in four major categories of environmental surface: flooring, walls, countertops, and ceilings.

Floors of a hospital, especially those located in high activity areas, must be able to endure the heavy traffic of both people and equipment. In terms of infection prevention, Noskin and Peterson (2001) consider carpet particularly detrimental for patients due to its ability to harbour pathogens. Ceramic tile, another flooring material, can be evaluated by the amount of associated grout. For example, larger tiles warrant less grout, and therefore decrease the possibility of reservoir development. Smaller tiles, on the other hand, require more grout, increasing the porous area on the floor in which pathogens can reside. The material of flooring must be considered in terms of traffic endurance, ability to become a pathogenic reservoir, and ease of cleaning.

Hospital walls must be washable, durable, and able to withstand impact from stretchers and other frequently moved hospital equipment. However, Noskin and Peterson (2001) point out

that these elements pose no direct threat to infection spread unless moist or damaged. It is recommended that welded joints and plumbing boundaries be sealed, smooth, and water-resistant. Loo et al. (1996) conducted a study in which a major infection control technique called for the mixing of copper-8-quinolinolate, a proposed toxin remover, into hospital room paints, but the results were not statistically significant. O'Connell and Humphreys (2000) report that paint is not noted as having a major effect on infection transmission so long as the coat is properly sealed and smoothed.

Ceilings and countertops are also among hospital surfaces that can potentially harbour pathogens. Ceilings must be area appropriate; for instance, they can be porous and inexpensive in major corridors and waiting rooms, but in patient rooms, isolation wards, and operating rooms, they must be impermeable to fluids and microbes (O'Connell & Humphreys, 2000). Such impermeable materials include stainless steel and some plastics. Noskin and Peterson (2001) have recently connected a widely-used ceiling material known as acoustic tile, thought to have beneficial effects on patient recovery, to a negative patient health effect. In an effort to reduce noise and patient stress, acoustic ceiling tiles were installed, but their porous nature caused them to become pathogenic reservoirs. O'Connell and Humphreys (2000) admit that, because of their continuous exposure to the hospital environment, countertops have an increased degree of contamination risk – these surfaces must be nonporous, solid, and sealed.

Although a good deal of a hospital's cleaning responsibilities are held by independently employed contractors, the ability to clean certain elements of the hospital environment may affect staff satisfaction. Staff members are held accountable for maintaining a safe environment for the patients over the course of the day, which at times may involve cleaning. Redshaw et al. (2004) found that surfaces coming in contact with patients become "problematic areas" when the surfaces themselves "lift off," "bubble up," or have recessed regions due to texturing (p. 36). Staff surveyed by the researchers stated that cleaning such surfaces is difficult and time consuming.

The degree of cleaning ease must also be taken into consideration when designing flooring, ceilings, walls, and countertops. In order to facilitate efficient and thorough cleaning, these surfaces must be carefully selected according to their properties and placement. According to O'Connell and Humphreys (2000), environmental surfaces have the greatest potential to serve as microbial reservoirs; effective and meticulous cleaning of these surfaces must be enforced by hospital staff to reduce the risk of nosocomial infection.

2.2 EXISTING METHODOLOGIES FOR HEALTHCARE FACILITY ASSESSMENT

Several methods exist for extracting data to determine the effects of the architectural environment on patient well-being. In the past, researchers have designed a multitude of study-specific surveys to establish patient preferences and perceptions. Questionnaires often include both pictures and verbal descriptions to clearly depict environmental settings. Some studies have incorporated a checklist, used a rating scale, or posed simple yes/no questions. Although relatively simple, these methods depend entirely upon the opinions of patients incorporated in the study, which may not accurately portray overall opinions (Kaplan, 2001; Wilson et al., 1972).

Other studies have observed patient behaviour over specific intervals of time (Ittelson et al., 1970; Morgan et al., 1998). This method may be more subjective because it incorporates the biases of the observer. To avoid this bias, Ulrich (1984) advocates the appointment of a medical professional as the observer or the review of nurse comments on past medical records. Quantitative health indicators such as length of stay or medication usage can also be obtained from clinical charts. When considering numerical data, chi-square tests and t-tests can be used to determine statistical significance (Ryder, 2005, Appendix A).

According to Rubin, Owens and Golden (1998), the most popular study designs for evaluating patients are randomised controlled trials, experimental trials with paired data, observational studies with paired data, and observational studies of different groups. In a randomised control trial study design, patients are randomly assigned environmental conditions. Unfortunately, complete randomisation is often impossible in healthcare facilities because of time and space constraints. Experimental trials with paired data expose each patient to each condition at different times. This study design is particularly effective in determining the significance of particular variables, but it is also difficult to perform in functional healthcare environments. Observational studies examine patients under different environmental conditions over a course of time. The study can be conducted with paired data or with different groups. Obtaining paired data involves observing the same patients as they are naturally exposed to each environmental circumstance. This study is somewhat subjective because variable assignment is dictated by hospital and patient conditions, and results are based on observations. Alternatively, previously established groups can be assigned to a certain variable in order to identify observational differences between groups. It is difficult to determine the validity of these results because many uncontrollable variables exist between groups. Rubin et al. (1998) stress the importance of understanding each study design, along with their strengths and weaknesses, in order to critically analyse the results of other studies.

The Multi-phasic Environmental Assessment Procedure (MEAP) is a combination of five instruments that were created by Moos and Lemke in order to examine the environment's influence on the staff. One particularly applicable environmental assessment tool of MEAP uses a rating system to evaluate physical and social environments in healthcare facilities. Although the rating system was considered an extremely useful tool, it does have a weakness. The ratings are based upon the opinions of one person whose observations may not be an accurate portrayal of those of the general population. In an attempt to limit this influence, MEAP has a handbook of guidelines for the observer to follow (Porter & Watson, 1985). MEAP may not be the most appropriate system for assessing all healthcare environments, but it is an example of a successful assessment procedure used in the past.

2.3 POTENTIAL FOR A MULTIVARIABLE METHODOLOGY APPLICABLE STATEWIDE

The Department of Human Services (DHS) in Victoria was interested in developing a methodology for evaluating the effects of the built environment on patient health outcomes and staff satisfaction statewide. All methodologies revealed by the literature review either investigated the effects of a single environmental variable or were created for a specific healthcare facility. Thus, the need was presented for a methodology which addressed multiple environmental variables and could be applicable to many healthcare facilities.

Single-variable methodologies have proven themselves to be effective in addressing specific environmental problems. Mazer (2003), President of Healing Health Care Systems, developed a multi-step noise-reduction methodology for identification, assessment, and reduction of noise in healthcare facilities. The process involves creating an interdisciplinary committee which requires expensive employee training in the areas of care and administration. The methodology also requires the establishment of maintenance and purchase standards (Mazer, 2003). Each step of the methodology, although complete and thorough, addresses the single issue of noise reduction and requires complex budgeting. It would not be economically feasible for facilities to implement a different methodology for each aspect of the built environment, but such means of evaluating one variable can serve to identify specific factors to be addressed in future multivariable assessment tools. Knowledge of methodologies limited to specific environmental variables may also assist in interpreting which of these variables are linked to each observed change in patient health outcomes and staff satisfaction.

Lawson (2002) created a methodology to guide the construction of the architecturally advanced Mill View Hospital in the United Kingdom. Upon completion of construction, surveys were administered to patients in both the new and unaltered facilities. Although the

study provided valuable findings for this facility, the methodology was created specifically for Mill View. Whether the findings are relevant to other facilities remains unknown, making the results currently inapplicable to other healthcare facilities. Developing a unique methodology for each facility based on their healthcare infrastructure and policy would be effective, but it would also involve a great amount of capital.

No methodology is known to exist which could assess the overall effects of the environment in all of the healthcare facilities in Victoria. The development of such a methodology would not only save money because the need to create and implement facility-specific methodologies would be eliminated, but it would also allow the effects in different facilities to be directly compared. A methodology which is applicable statewide would aid in advancing the understanding of the overall effects of the environment on patient and staff well-being in all of Victoria.

3 Procedures

Our literature review revealed a relationship between the built environment and patient health outcomes, and identified the need to develop a healthcare facility evaluation tool specialised for Victorian hospitals. Numerous methodologies that assess the impact of the built environment on patient health outcomes and staff satisfaction have been discussed, but they are all specific to a particular healthcare facility or environmental variable. In order to develop an assessment methodology appropriate for the healthcare infrastructure and policies of DHS that would allow them to justify investments in healthcare facility refurbishment, more information was necessary. We sought to establish a methodology with which pre- and post-facility renovation data could be compared for differences in patient health outcomes and staff satisfaction. In this section, procedures used to gather additional information, analyse the findings, and create particular evaluation tools are described in detail. The rationale for each procedure is also clarified.

Upon establishment of a methodology suitable for DHS, we implemented our developed tools in two existing healthcare facilities in order to collect baseline data. We also constructed a framework for a follow-up study, which will be conducted by another group after renovations are completed. The details and motivation of these steps are established in the following subsections; a graphical view of the procedures taken can be seen in Figure 1. Upon completion of Capital Management Branch (CMB) staff focus groups and interviews, as well as preliminary hospital visits, we gathered information regarding pertinent elements of the built environment, the feasibility of our methodology implementation, specific hospital sites, availability of quantitative health indicators, and studies approval for each of the hospitals. We used this knowledge to develop our surveys and evaluation tools, which consisted of patient and staff satisfaction surveys, a building evaluation tool, and methods for quantitative health indicators acquisition and analysis. We then collected and organised baseline data in an existing hospital facility. A follow-up study to be completed in twelve months will collect data from the newly renovated homologues of the old wards. We developed a framework for this follow-up study, which serves as the major deliverable for our project and consists of patient and staff satisfaction surveys, the building evaluation tool, data organisation tools, a user’s manual, and the actual baseline data.

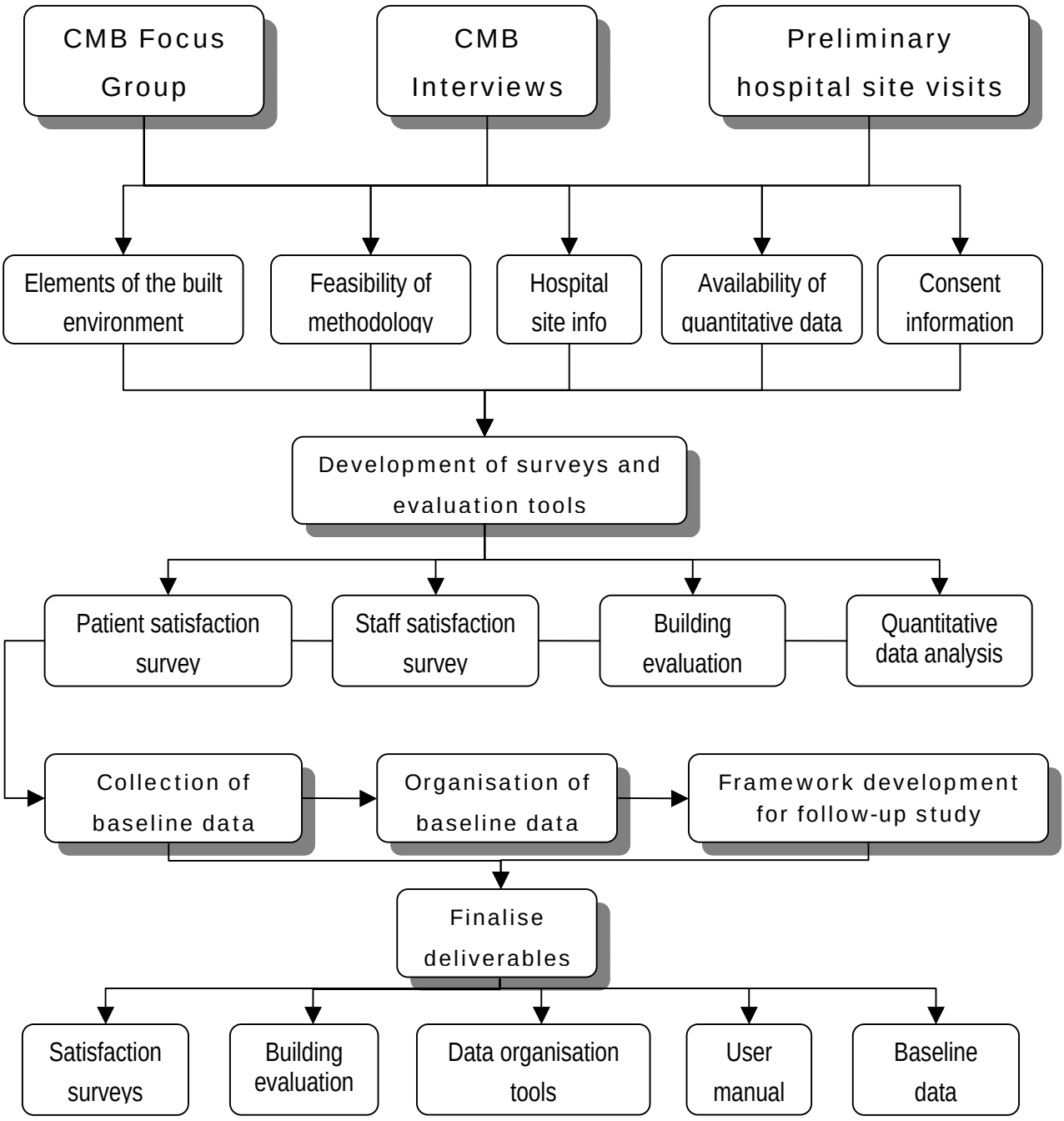

Figure 1: Flowchart of procedures used

3.1 IDENTIFICATION OF FACTORS TO BE ADDRESSED IN METHODOLOGY

We began the methodology development process by gathering information relating hospital design to architectural improvement, patient health outcomes, and staff satisfaction. A literature review and evaluation of relevant subject material, found in Chapter 2, served as this initial, information-gathering step. We then acquired information about the existing

Victorian healthcare system in order to understand the operations and goals of DHS, specific information about existing healthcare facilities, and elements of the built environment affecting patient health outcomes and staff satisfaction.

3.1.1 General Healthcare Information

In order to further our understanding of Victorian healthcare operations, we gathered information regarding the current healthcare situation in terms of renovation priorities, general structure of public and private healthcare sectors, and major political and economical motivations or issues within the system. We obtained this information by interviewing three Project Managers, one Design Manager, one Principal Architect, and one Strategic Asset Planning and Specialist Services Manager at the Capital Management Branch (CMB) Office of DHS. These individuals were experts in the field of Victorian healthcare, and could provide information regarding the structure and operations of the healthcare system. The questions that we asked them included:

- Can you explain to us the healthcare system of Australia?
- In terms of an income bracket, what class or classes of Australians pay for private insurance?
- Overall, how are the hospital and physician services provided to the Australian people?
- Outside of hospitals, how do Australians see doctors for services such as yearly physicals and specialist services?
- Is there a specific area which Australian healthcare facilities are trying to improve upon?
- What is the process by which a decision is made for a site to be redeveloped?
- How are hospitals grouped into agencies? Do agencies offer similar services or are they just in the same area?
- When a renovation project is completed, is there a procedure that DHS follows to evaluate it?

Pertinent information acquired from these interviews, as shown in Figure 1, was used to develop our methodology in accordance with the operations of the Victorian healthcare system and DHS. This information allowed us to realise the potential applicability of the methodology throughout Victoria (See Appendix A for interview transcripts).

3.1.2 Site-specific Information

Examination and evaluation of existing healthcare facilities under construction was an important step in our preliminary information gathering. We were presented with acute inpatient wards of six facilities for this project, three of which were quickly eliminated because of inappropriate renovation timelines. After narrowing our focus, we gathered information about each of the three remaining facilities in order to determine whether the nature of renovations and available data for each were applicable to our project.

Information Gathering. We gathered site-specific information by interviewing Project Managers and other staff in the CMB. These interviews were conducted in such a way that we could extract appropriate information regarding the nature and timeline of each hospital's renovations, as well as the motivation behind the projects. We asked questions such as:

- What do you know about the general background of the site and the motivations for its improvement or relocation?
- What types of renovations are being done to the facility?
- Does the change involve renovation of an existing facility or an actual move to a new facility?
- Are you aware of a general timeframe for the redesign projects?
- Will the timeframe be conducive to baseline and follow-up data collection in twelve months?

Evaluation and Selection of Hospitals. The next step in examination of our three selected hospitals was to visit them with the purpose of both observing the built environment and interviewing staff and hospital engineers, the contacts for which were established by our project liaison and other CMB staff. Unfortunately, we were unable to establish contact with one of the hospitals, but elimination of the third hospital allowed time for a more complete pilot test at the other two. During these visits, we were able to obtain an accurate perspective of the hospital wards in terms of built environment, patients, and staff. Important aspects of the built environment and hospital operation were further examined by interviewing hospital engineers and recorded using a digital camera.

The visits also allowed us to discuss the proposed implementation of our methodology with both patients and staff at each facility. These groups provided feedback on the willingness of patients and staff to complete satisfaction surveys, opinions of the current renovation projects, and information on the availability of certain patient data desired as outcome measures for our methodology.

3.1.3 Outcome Measures

As indicated by our literature review, the built environment has a multifaceted effect on patient health outcomes and staff satisfaction. Therefore, we sought to identify prevalent outcome measures for incorporation into our methodology. Identification of the most important outcome measures also allowed us to keep a proper scope of the project in terms of content and timeline feasibility.

From the outset of the project, DHS indicated the desired outcome measures to be the following:

1. *Length of patient stay*

   Length of patient stay data availability was determined by further investigation into the Information Technology or Information Services departments at each hospital. These data are a widely used measure of overall facility efficacy, so it is typically available.

2. *Usage of analgesics*

   We investigated the availability of data concerning usage levels of pain medications, or analgesics, by discussion with our project liaison, Judith Hemsworth. She recommended that we pursue this information through hospital pharmacy personnel. We were also told that DHS hoped to observe a decrease in stronger analgesic usage and an increase in weaker analgesic usage; therefore, we based data organisation in this quantitative section of our methodology on the strengths of various analgesics.

3. *Incidence of nosocomial infection*

   As nosocomial infection is a key indicator of hospital performance with numerous implications, more complex epidemiology knowledge may be necessary to effectively document its occurrence. Discussion with hospital administration allowed us to determine what exact documentation of nosocomial infection was available, and we were able to use this information in the creation of our assessment tool. However, we were unable to obtain this information from either of the hospitals because of what they felt to be a lack of relevance to our project.

4. *Patient satisfaction*

   In order to determine a means by which to evaluate patient satisfaction, we consulted with our project liaison and other members of the CMB staff. We decided to develop a survey that would assess patient satisfaction with the built

environment. Through determination of relevant environmental variables, as discussed in this section, we determined the content of these surveys.

5. *Staff satisfaction*

   In a manner similar to that of patient satisfaction, we decided to use a survey to assess staff satisfaction with the built environment. This survey was developed through consultation with CMB staff via focus groups and interviews, as well as hospital visits.

Using these as a basis for our methodology, we determined what information was available and how we could gather this information in order to accurately assess each outcome measure.

3.1.4 Environmental Variables Impacting Outcome Measures

In order to develop detailed descriptions of the existing hospital ward environments for the purpose of comparison with the new wards, we investigated environmental variables of the built environment that may have an effect on our outcome measures. The determination of elements of the built environment to include in our methodology was completed using various resources, including our literature review. The primary foci of this determination were developing a building evaluation tool for ward comparison purposes and classifying facets of the physical setting into broader categories to consider for satisfaction surveys and organisation purposes.

Following our initial literature review, found in Chapter 2, our next step in this investigation was interviewing CMB staff, whose titles were mentioned previously. These individuals were very knowledgeable in the field of built environment effects on health outcomes, and we realised the potential impact they could have on our evaluation. During these semi-structured interviews, we asked them to expand upon hospital infrastructure issues, depending upon their areas of expertise.

To further expand our knowledge of the built environment and its effects on patient and staff satisfaction, we conducted a focus group. This focus group, which consisted of CMB personnel who we had already interviewed, had the primary purpose of brainstorming elements of the built environment which may have an effect on patient health outcomes and staff satisfaction. Prior to conducting the focus group, we developed a preliminary list of environmental variables, categorisations of basic observations in relation to these variables, and questions regarding patient and staff satisfaction that could be asked in each subject area. Staff members in attendance included two Project Managers, a Design Manager, an Asset

Planning Project Manager, and the Strategic Asset Planning and Specialist Services Manager. They provided us with valuable feedback through this relatively informal meeting, and we were able to use this information to narrow the scope of our project.

Gaining a more clinical perspective of our project also allowed us to determine pertinent environmental variables. We gathered patient and staff perceptions by visiting hospital sites to observe variables on a pre-written list and take pictures of certain aspects of the environment. In addition, we conducted informal interviews with patients and staff about which elements of the built environment they feel significantly affect their satisfaction.

Information gathered by interviews, the focus group, and hospital visits was used to narrow the scope of the project to vital environmental factors around which our methodology could be based. With this knowledge, we were able to develop the methodology in such a way that the built environment was evaluated specifically in terms of its effects on patient health outcomes and staff satisfaction.

3.2 DEVELOPMENT OF METHODOLOGY

After conducting our literature review and identifying relevant environmental factors, we were prepared to create a methodology to evaluate the impact of the built environment on patient health outcomes and staff satisfaction. We developed tools for gathering three forms of data: building evaluation data, patient and staff satisfaction data, and quantitative health indicators. First, we related significant environmental variables to how each of these factors could be evaluated and how they might influence patient and staff satisfaction. From this information, we drafted a building evaluation tool and patient and staff satisfaction surveys. Next, we visited hospital sites to determine what quantitative health indicators were available, what form these data were collected in, and how these data could be interpreted. Finally, we created a means of organising the information collected from the building evaluation tool and satisfaction surveys.

3.2.1 Creation of Building Evaluation Tool

Following the identification of significant architectural components of the built environment, we sought to develop a standardised method to document observations about these variables in each healthcare facility. The detailed observations of the existing healthcare environment will be helpful in recognising which elements of the built environment have been modified during a follow-up study. Differences in patient health outcomes and staff satisfaction can then be linked to alterations in the built environment. Future researchers may choose to use this same observational analysis tool to collect environmental data from facilities after

renovations are completed so the architectural environments can be efficiently compared and contrasted.

With the help of a focus group of CMB staff and informal interviews with hospital administration, we made a list of observations about each factor. Preliminary visits to wards in each facility helped to expand this list of possible observations. We then condensed the observations so that the evaluation tool was easy to use and based on objective measures whenever possible. In order to save time and further standardise the observational analysis, we included yes/no questions whenever applicable. Other observations involved the number of environmental features present or the size of architectural elements. When a Likert scale was necessary, we developed a rubric to define the ratings. The final building evaluation tool was generated using a computer spreadsheet and colour coded by environmental feature. The developed building evaluation tool can be found in Chapter 4, the user's manual.

3.2.2 Creation of Satisfaction Surveys

Patient and staff opinions or preferences regarding aspects of the built environment that could not be accurately gathered from our building evaluation were incorporated into surveys. We created two separate surveys to assess patient and staff satisfaction, respectively. Information gathered from background research allowed us to form the preliminary survey questions. The CMB staff, during a focus group, critiqued the surveys and provided input from their knowledge of the field and personal hospital experiences. We also presented the initial survey to hospital administration during our first visits to the facilities in order to gather the opinions of individuals with a more clinical perspective. We then refined the surveys based on the feedback of these hospital personnel.

We incorporated yes/no questions or rating systems into the surveys so that the results could be easily quantified. The majority of the survey questions were based on a Likert scale, which allows patients or staff to rate their attitude towards a particular field on a scale of one to five. This rating system collected data that were easy to quantify and provided more information regarding satisfaction than simple yes/no questions. The final surveys were generated using a computer word processing program. The first page of both surveys explained why the survey was being completed, assured confidentiality, and provided examples of how to complete the survey.

Patient Satisfaction Survey. This survey addressed patient opinions about each aspect of the built environment. We included questions about gender, age group, length of stay, and ward type, because these variables could potentially influence patients' attitudes towards their

surroundings. Upon consultation with hospital administration at our preliminary site visits, we decided to conduct the surveys face-to-face with the patients in an attempt to keep their interest and increase response rate. This method would provide patients with more social contact and allow patients not physically capable of completing the survey the opportunity to participate in our study. The developed patient satisfaction survey can be found in Chapter 4, the user's manual.

Staff Satisfaction Survey. The staff satisfaction survey included questions about how well the built environment supported the delivery of services to patients, personal satisfaction with the environment, and perception of patient satisfaction. The staffs of Victorian healthcare facilities include both agency and hospital-employed staff. Agency staff members generally do not work in the same ward over an extended period of time. These individuals may not have as much invested in a specific facility, but they experience a wider range of environmental conditions. These considerations may alter their satisfaction level with a particular hospital facility; therefore, we opened our survey to both agency and hospital staff. The developed staff satisfaction survey can be found in Chapter 4, the user's manual.

3.2.3 Consideration of Quantitative Health Indicators

We determined the availability of quantitative health indicators by speaking with appropriate personnel from each hospital. Each site under consideration for study had its own specific regulations regarding the release of information about patient length of stay, administered medication levels, and levels of nosocomial infection. Before we made our hospital site visits, consideration was given to methods which would be applicable for the acquisition of each quantitative health indicators.

3.3 IMPLEMENTATION OF METHODOLOGY

The proposed methodology for relating physical factors of a hospital environment to satisfaction levels and specific quantitative health indicators was built upon knowledge gained from our literature review and information gathered during specific facility location visits and CMB staff interviews. Because our methodology involved a single approach to each type of data collection and analysis, the evaluation of applicability and feasibility of each of the evaluation tools we had designed was necessary. We gained confidence via implementing our methods in existing healthcare facilities and subsequently collecting baseline data. Such implementation worked to confirm methodology feasibility, applicability, and sustainability, while revealing components of our built environment evaluation tools whose implementation procedures were unsuitable.

Our evaluation tools were designed primarily for the collection and organisation of data rather than for data analysis, a task that will be completed as part of a follow-up study by another group of researchers. The weighting of environmental factors, scope of assessment coverage, and evaluation tools themselves should be reviewed and altered based on research, our findings chapter, and future DHS requirements by those responsible for data analysis. Because this methodology was designed with the intent of standardised ward implementation and future usage within Victoria, our assessment tools must accommodate collection of data from a range of hospital and ward types. This wide range of applicability lends itself to relatively simple statistical analysis by individuals other than the tool creators. Our methods gathered relevant data, but all patient identification was removed from these data, ensuring confidentiality and adherence to basic human studies considerations.

3.3.1 Environmental Observation and Evaluation

Using the developed building evaluation tool, we gathered information about the built environment of wards from each hospital site. Through individual observation and the questioning of building engineers, we were able to obtain information concerning each hospital site prior to its renovation or relocation. Using this information, descriptions of each site environment were composed (see Appendix C and Appendix D). Those conducting the follow-up study will use these built environment particulars for the purpose of comparison.

3.3.2 Survey Administration

Patient and staff satisfaction surveys were administered in the hospital setting. Because of the strict timeline of our project, the data collection time was restricted to two weeks. We dedicated one day per week to gathering data from each of the three hospital facilities.

Since the average patient stay is approximately six days on these wards, we administered patient surveys toward the end of their stay in order to give the patients time to generate an opinion about the environment. The average ward has 32 beds, and we attempted to collect data from ten patients per ward because of the possibility that not all patients may fit into the proper timeframe, and that others may wish to not participate in the study at all. We collected data on different dates in order to help reduce the possibility that satisfaction levels were affected by an outlying event such as construction or an excessive influx of patients.

Each ward had approximately ten to twelve staff members present during each of the three shifts. We distributed the staff satisfaction survey to at least ten staff members in each

facility. We administered the survey to staff that worked during different shifts since the varying responsibilities of each shift may generate different perceptions of the environment. This method of staff surveying was achieved by administering the survey before and after a change in shift; we left the survey with instructions for staff working shifts during which we could not be present.

3.3.3 Data Collection of Quantitative Health Indicators

We obtained data regarding patient length of stay on a ward level by consulting with the Information Technology or Information Services departments at each hospital. This information was not difficult to acquire, as it was gathered by usage of a simple query and provided in a relatively simple format.

Analgesic usage data were acquired by consultation with the pharmacy departments at each hospital. Pharmacy personnel advised us to gather usage data regarding different strengths of analgesics, and provided us with this information by running a query for certain analgesics on a ward level for the past six months. The pharmacists gave us spreadsheets with the requested data, and we were able to extract pertinent usage information for inclusion in our report.

Nosocomial infection data, on the other hand, were much harder to acquire. After establishment of contact with appropriate Infection Prevention department personnel at each hospital, we were advised that nosocomial infection data were either not robust enough for the wards under study or too complex for our understanding to be included in our project. As a result, we were forced to omit nosocomial infection as an outcome measure in our baseline data collection.

3.3.4 Data Organisation

Information collected using the building evaluation tool was entered into spreadsheets for organisational purposes; a database was developed for the patient and staff satisfaction surveys. Queries were run on this database, and data reflective of built environment themes were extracted; this information was copied and pasted into summary spreadsheets. Within these spreadsheets, we created a worksheet for each previously determined theme of the built environment. The data acquired pertaining to the quantitative health indicators were also entered into appropriate spreadsheets. These spreadsheets, along with the survey database, serve as a method of storing the data for reference by future researchers. The data analysis methods were not within the scope of our project; these are the responsibility of those who complete the follow-up study in the renovated facilities.

3.4 ESTABLISHMENT OF FRAMEWORK FOR FOLLOW-UP STUDY

Twelve months after the development of this assessment methodology and collection of baseline data from old facilities, the Department of Human Services will perform a follow-up study in the architecturally redesigned homologues of the old facilities. As previously stated, it is important that the same methods and evaluation tools be used to ensure continuity of data between initial and follow-up studies. To assist in these endeavours, our project incorporated the development of a framework to enable persons other than its creators to use the evaluation tools and carry out subsequent data collection. This framework was conveyed by a written report detailing pertinent built environment attributes, our standardised evaluation methods and surveys, and a user's manual explaining the building evaluation, satisfaction survey usage, and data organisation.

We did not assume that individuals chosen to conduct the follow-up study will intuitively know how to use our evaluation tools. A user's manual (found in Chapter 4) was developed to provide information regarding the type of data and means of collection for follow-up procedures. The main purpose of the user's manual was to familiarise future researchers with the methods that were used to collect the baseline data. It facilitates a direct completion of the follow-up study and data collection from the new and renovated facilities. The content of the user's manual was also written with a broad enough scope to guide future studies at other facilities.

A majority of the user's manual details the use of our project's deliverables – the patient and staff satisfaction surveys, the observational building evaluation, and the tools for data organisation; however, the manual also explains the means by which quantitative health indicators such as levels of analgesic usage, patient length of stay, and instances of nosocomial infection are to be acquired and recorded. The contents of the manual include a brief overview of our project and the procedures we used. For each survey and the building evaluation tool, there are detailed instructions on how to administer or fill out the necessary forms. Specifically, for the building evaluation tool, there are instructions for each category or theme of the built environment. In addition, the user's manual contains screenshots of the data organisation tools we developed and instructions on how to use this software. As a convenience, our software tools are included on a CD-ROM which was bundled with the user's manual.

4 A Methodology to Assess Effects of the Built Environment on Patient Health Outcomes and Staff Satisfaction

The goal of this chapter is to familiarise the reader/user with the content and implementation process of the assessment tools developed as a part of this methodology. We also present guidelines for methodology administration, and inform the user of specific limitations that may be present in each step. The rationale for the proposed strategies of implementation will be discussed as well. This chapter is written to act as a stand-alone set of instructions for anyone who wishes to conduct a before and after evaluation of the hospital built environment and its effects. As such, the chapter includes its own cover page and table of contents. Satisfaction surveys and building evaluation forms are available on CD-ROM and also in Appendix B. Care should be taken that these tools are made available if this chapter is separated from its original report.

Investigation of the Effects of the Built Environment on Patient Health Outcomes and Staff Satisfaction

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User's Manual

May 2005

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4.1 CONTENTS OF THE USER'S MANUAL

4.2 BACKGROUND INFORMATION

The procedures and assessment tools discussed in this user's manual were developed to evaluate the built environment of healthcare facilities and its effects on patients and staff. These tools were designed with certain outcome measures in mind: length of patient stay, incidence of nosocomial infection, usage of analgesics (medication levels), patient satisfaction, and staff satisfaction. It is important to note that the tools address only elements and effects of the *built environment* – floor coverings, lighting, noise levels, wayfinding, etc. They *do not* include elements outside the realm of the built environment (food, quality of care, etc.), nor do they constitute comprehensive satisfaction surveys for either patients or staff members.

4.3 SITE SELECTION

In order to successfully implement this methodology, one must select a hospital facility appropriate for the study. Proper facility selection is based upon renovation timelines and ward comparability, allowing for comparison of pre- and post- renovation data.

To ensure a degree of consistency in both the demographics examined and the data collected, the hospital level and ward type should be considered. This methodology was developed with Level 5 hospitals and Level 6 teaching hospitals in mind. It may be suitable for other hospital facilities, but the user should take the intended survey design into consideration when selecting facilities.

Selected ward(s) should service adult inpatients and be of moderate size (20-40 beds). Suitable ward types include general medical and surgical wards. This methodology is not necessarily appropriate for specialised wards (neurosurgical, cardiac care, paediatric, burn, etc.), because these may require specific layouts, higher proportions of medical equipment, or stricter air transfer/quality standards. Such specific requirements may work against certain design changes in the built environment. For example, fresh air may be a desirable amenity for most patients, but it would be detrimental to the recovery of burn victims. If the built environment of a specialised ward is to be assessed, additional evaluation tools tailored to the particular environment should be developed for features such as an additional room for families and "toy" rooms in paediatric wards.

The facilities selected for this methodology should be scheduled for infrastructure refurbishment within a few months' time of the first data collection. When using the assessment tools for pre-renovation evaluation, the built environment and satisfaction levels

should be examined at least one month before the actual renovation/relocation/construction process is to take place. This method of selection is done to ensure that data collected is not skewed by the anticipation of changing conditions or heightened periods of activity. Follow-up data should be collected a minimum of four months after occupation of the new facility to ensure that the staff adjustment process has taken its course and any early feelings of extreme satisfaction, or even confusion, have worn off.

4.4 PRELIMINARY SITE VISITATION PROCESS

Prior to the actual collection of data from the hospital ward, it is important to arrange a preliminary visit to the hospital to become familiar with the facility. At the same time, contacts should be established with key persons who will be able to assist with the completion of the research. These contacts will be approached to arrange the permission necessary for surveying patients and staff and collecting built environment data. Other persons, such as building engineers and nurse unit managers, should be able to provide direct assistance with answering some of the questions about the hospital ward.

4.4.1 Facility Preparation

An individual within the hospital's infrastructure or building engineering department who also has contact with those responsible for hospital operations and studies approval should be contacted before attempting to use any of the assessment tools in a ward. A face-to-face meeting should be scheduled with this person, during which the purpose of the methodology, assessment tools, and nature of surveys should be explained. At this meeting, several important contacts within the hospital ward should be made:

- A building engineer who can discuss specifics of the ward to be evaluated;
- A nurse unit manager responsible for staffing the prospective ward; and
- A person with access to quantitative health indicators such as length of stay, rates of nosocomial infection, and administered analgesics for a particular ward.

The need and process for obtaining human studies approval, allowing for the future administration of surveys and the execution of a building evaluation, should also be discussed at the preliminary visit. This step may entail contact with hospital supervisors or the hospital CEO to explain the purpose of the methodology and nature of the assessment tools. This approval process may be expedited by writing a letter of introduction and study intent, to which copies of the actual assessment tools are attached; the main contact can then pass such materials on to the proper administrators/superiors/departments.

Another factor involved in the approval of the study is the nature of interaction with patients. Hospital administrators and nurse unit managers will be instrumental in securing human study approval and establishing the potential for face-to-face interviews. If it is determined that such a level of patient interaction is not permissible, changes to survey administration may be necessary.

Note – If it is determined by the hospital that human studies approval is required for an assessment, the timeframe for methodology implementation and data collection may be delayed to secure the approval.

4.4.2 Facility Contacts

The following sections describe the information that should be collected from hospital building engineers and nurse unit managers. Once the researchers have obtained permission to continue their study from hospital administration, ward-specific personnel should be contacted to obtain particular details regarding different aspects of the built environment and other quantitative health indicators. Two individuals instrumental in the completion of the study are the design/building engineer and the nurse unit manager of the ward under investigation.

Design/Building Engineer. Providing this individual with copies of the assessment tools included in the methodology may allow him or her to identify certain aspects of the tools that do not apply due to the nature of the facility, level of provided services, or engineering design. In addition, there are a number of questions within the building evaluation tool that cannot be completed by simple observation of the physical ward (e.g. ward air exchange rate). Individual researchers may not be able to notice structural features of the environment, so it is important that such a professional be allowed to add comments concerning the built environment's design.

Nurse Unit Manager. The nurse unit manager is responsible for overall ward operations. His or her administrative duties include staff management, performance evaluation of the ward, and supervision of patient care and assessment. Copies of both the patient and staff satisfaction surveys should be provided to this person for review. He or she can identify patients suitable for survey participation based on their physical and mental condition and staff members who may have the free time and working experience needed for survey completion. In addition, the nurse unit manager will be able to answer detailed questions concerning the staffing profile of the ward and offer valuable input regarding increasing the

comfort of patient survey administration (where to administer the surveys, need for a 3rd-party presence, etc.).

4.4.3 Availability of Quantitative Health Indicators

Assessing the three main quantitative health indicators – length of stay, instance of nosocomial infection, and analgesic usage levels – is a site-specific process. One may find that a hospital does not collect a particular statistic on a ward-by-ward basis, or that it is not willing to make this information available for the study. If this is the case, such an evaluation cannot be performed for that particular ward. It is important to establish contact with those individuals in a position to access such statistics as early as possible to leave ample time for them to access and explain the data.

4.5 DATA COLLECTION PROCESS

The following section details the methods by which data should be collected if the original implementation of the methodology is to be replicated. Processes of patient and staff subject selection, survey administration techniques, and building evaluation are discussed, as are the limitations of each. The rationale for each consideration or method is also explained.

4.5.1 Patient Satisfaction Survey

The patient satisfaction survey found in Appendix B should be administered in order to assess how well the built environment supports the needs of patients. Enough patients should be surveyed so that the general opinion of all patients is accurately portrayed; surveying at least one-third of the total number of patients which the ward is capable of accommodating is recommended. Survey administration techniques must be considered in detail, and such methods will be discussed in this section. Proper participant selection and survey administration techniques have a significant impact on the assessment of the hospital ward, and therefore must be standardised to ensure repeatable and reliable data collection.

Face-to-face interviews, in which the researcher asks the patient the survey questions and completes the survey according to the responses of the patient, are a very effective means by which to gather reliable data. These interviews, as opposed to patients completing the surveys themselves, are a more effective option for data collection because not all patients will be physically capable of sitting up and writing. Personal contact with the patients allows the researchers to clarify any questions and record additional comments the patient may have. In addition, the patients may be more willing to participate in the study if they are offered personal contact with researchers and do not have to take the time to fill a survey out

themselves. An uninterested participant completing the survey on his or her own may select responses without any consideration just to finish the survey, whereas a patient engaged in personal conversation with the researcher is more likely to think about and justify responses. Therefore, the response rate of the survey and accuracy of the responses may be increased through face-to-face interviews.

Criteria for selection of patients should include cognitive function, physical health, and length of stay. The patients must be able to engage in coherent conversation and demonstrate normal cognitive function. In terms of physical health, the patients must be sufficiently stable that the researcher can conduct face-to-face interviews without impeding the patients' recovery. Surveys should be administered toward the end of the patients' stays, making sure they have resided in the ward for a minimum of three days, allowing them to offer more complete personal perceptions of their hospital experience.

A limitation that may be encountered during the administration of surveys via face-to-face interviews is that of language barriers. Hospitals in linguistically diverse areas care for patients who speak many different languages, and therefore must employ interpreters to ensure efficient communication between patients and staff. If necessary, hospital interpreters may be available to assist in the collection of survey data from a variety of linguistically diverse patients. At the same time, it is important to realise that an interpreter may not accurately deliver the researcher's words to the patient, and vice-versa.

When administering the survey, the researcher should give the patient the cover sheet and give a brief overview of why this interview is being conducted. Patients should be reassured that the information they provide is completely confidential and that identifying information will not be collected. Interviews that proceed without communications difficulty should be expected to take about 20 minutes to complete.

4.5.2 Staff Satisfaction Survey

The staff satisfaction survey, found in Appendix B, should be completed by enough staff members so that it accurately represents the whole staff. It is recommended that at least one-third of the total nursing staff is surveyed. Administration of the survey to staff on different shifts can compensate for the possibility that the varying responsibilities of each shift may generate different perceptions of the environment.

Preferably, the staff surveys should be administered using a face-to-face method, which should take about 15-20 minutes. As mentioned previously, this technique maintains the interest of the participant in the survey and allows him or her to ask the researcher questions

regarding survey content, which may yield more accurate and thoughtful responses. In addition, the interviewer can gain a better understanding of the subject's perspective through this interactive discussion. Alternatively, it may be easier and more convenient to give the staff satisfaction surveys to the nurse unit manager for distribution throughout his or her staff. In this case, it is best to ask the nurse unit manager to distribute an equal amount to each of the three different shifts: morning, afternoon, and night. Inform the nurse unit manager that you would like to pick up the completed surveys on your next visit to the hospital. Whichever method of survey delivery is chosen should remain consistent throughout the study in order to avoid introducing additional variables.

4.5.3 Building Evaluation Tool

The purpose of the building evaluation tool is to enable standardised documentation of a ward's physical environment in both pre- and post-renovation conditions. The tool itself addresses individual elements of numerous areas of the built environment. Therefore, sufficient time must be allotted for an effective assessment to be completed. Although the assessment tool can be completed by any individual with a basic knowledge of the hospital environment, having a design/engineering/building professional present at the outset of the assessment will work to expedite the overall process. The evaluation is designed to be completed in approximately two to three hours.

Necessary Tools for Completion. In order to complete the building evaluation, the appropriate tools must be brought to the hospital site. The most important of these tools are the building evaluation forms and a writing instrument. It may prove helpful to bring extra copies to distribute to hospital staff who may be interested in the study. In addition, the following tools will be necessary to complete the building evaluation:

- Measuring tape (for measuring of rooms and hallways);
- Light meter (for measuring lux levels of lighting);
- Noise meter (for monitoring the decibel levels of noise);
- Digital camera (for taking pictures of the ward); and
- Ward floor plan (to assess the usage of space).

Conducting the Evaluation. After administrative staff and nurse unit managers have approved the project, the building evaluation should be completed using the forms provided in Appendix B. It is advised that this building evaluation be completed in a group of two to three persons so that the opinions of more than one person can be incorporated; collaboration is strongly recommended for the questions that have a rating scale. Many of the questions request information about the general ward, the staff base, and patient rooms. Ward and staff

base questions can be answered quite easily by walking around the ward and making simple observations. It is recommended that permission be received from nursing staff before any patient rooms are entered. Some of the questions request information about patient rooms dependent on the capacity of the room (i.e. single, double, quad, etc.); these questions should be answered once for each size room.

Overall, the building evaluation tool is quite self-explanatory. To begin the evaluation, the hospital name, ward/unit ID (the classification which the hospital assigns the ward), type of ward (e.g. acute inpatient, surgical, etc.), date of completion, and names of the researchers should be recorded. The tool classifies the built environment into twelve sections, and at the top of each section are the four types of possible response. In order to complete the building evaluation:

- Select columns should be ticked;
- # columns request a numerical response;
- YES NO should have the appropriate response circled; and
- 1 2 3 4 5 columns should have the most appropriate response circled.

There are a few questions that have write-in answers which are indicated by a wide box with a double underline. There is a half-page reserved for additional findings and comments which may be important but are not considered within the standard questions. In addition, certain questions may warrant comments, which can be written in any of the empty spaces surrounding the questions.

Photographs of certain elements of the ward should be taken while the evaluation is being completed for future reporting purposes. Items of interest include: the hallways of the ward, the staff bases, bathrooms, patient rooms, views from windows, and any other items of relevant interest. It is strongly urged not to include patients in these photographs, and permission should always be obtained before taking any pictures.

Rating language. Language is important when describing numeric responses. Rating questions in which 1 is the worst and 5 is the best should make use of the following rubric:

1 – poor or extremely insufficient/inadequate
2 – moderately poor, below average, sub par
3 – moderate, adequate
4 – good, fairly attractive/adequate/coordinated
5 – excellent, noticeably/attractive/efficient

Clarification of questions. Some of the questions in the building evaluation require further elaboration regarding specific measures. For this reason, the questions that need additional explanation are listed below, arranged in order by category. Please refer to the building evaluation tool in Appendix B when referring to the following comments.

Flooring/Surfaces

The Rate friction level questions have a slightly different rating system in which 1 and 5 are extremes and 3 is ideal. Users should make use of the following rubric:

1 – very or too slippery
2 – moderately slippery
3 – ideal
4 – moderately laboured mobility
5 – very or too laboured mobility

Room Size

For Dimensions, sizes are requested for patient rooms of various occupancies. The top row should indicate the number of beds in each room and the respective columns beneath each number should include the relevant dimensions from each type of room.

The Allocation of Ward Space is most easily determined by analysing the floor plans provided by hospital administration. The nursing staff can most likely answer the personal effects security questions.

Lighting

Lux levels can be measured using a light meter. Omit this question if light meters are not available.

A night lighting program refers to the presence of a different type of lighting pattern that is used during the evening and night hours. Night lighting could be a completely different type of lighting (e.g. wall lighting v. ceiling lighting), or the dimming of hallway lights.

Noise

Decibel Levels can be measured using a noise meter. Omit this question if noise meters are not available.

Windows

Views from bed is the same type of question structure as Dimensions, as it requests information from rooms with different patient occupancy levels. The top row should indicate the number of beds in each type of room and the respective columns beneath should indicate the number of beds per room in which a view can be seen.

Vent. System/Air Quality

Some of these questions must be answered by consulting with building engineers.

Control

In these questions, immediate refers to controls which are placed within easy access of the patient. This reference means that the patient does not need to get out of bed or move into an awkward position to have control of the factors listed.

4.5.4 Visual Aids

As mentioned in Section 4.5.3, a digital camera is needed to properly evaluate a ward's physical environment using the building evaluation tool. Pictures of the wards are needed to complete the narrative of the built environment, discussed in Section 4.6.4. There is no way to determine exactly which environmental elements should be included to produce an effective narrative. However, there are certain precautions which one must follow in order to include the images in one's report. First, one should speak with the nurse unit manager, determining if it is permissible to take ward pictures. If the ward can be photographed, the manager's preference concerning staff inclusion in photos should be determined (verbal consent vs. written consent). The following are some guidelines to avoid infringing upon the rights of both patients and staff:

- Patients CANNOT be included in any picture, even if they offer their consent.
- Generally, it is preferred that the faces of staff members do not appear in photos.
- Verbal consent from staff often is sufficient for photo inclusion, unless otherwise specified (by nurse unit manager or other administrator).

The following are some guidelines to producing sharp, high-quality digital photos:

- Set image size to a medium setting (approximately 1024 x 768) and the highest quality setting ("fine" or "superfine").
- Avoid using a flash when possible, due to the highly reflective nature of many hospital surfaces.
- Expect to be unable to eliminate glare, overexposure, and poor lighting in some conditions.

The following are examples of potential/recommended photos for the building evaluation categories:

A. *Ward Profile* – general ward/corridor, generic patient bed, patient room (if vacant)
B. *Ward Aesthetics* – artwork in staff base/patient room(s)/corridors, unique examples of art (statue, outdoor art, etc), equipment in corridors
C. *Flooring/Surfaces* – corridor flooring, patient room flooring, bath flooring, glare
D. *Room Size* – patient rooms (if vacant), staff base, areas for patient/staff security of belongings (if applicable)
E. *Lighting* – corridor lighting fixtures, night-time lights, individual patient lights, bed lighting for medical examination
F. *Noise* – intercom system, telephones, outside construction/traffic
G. *Windows* – views from various orientations (north, south, east, west), window, blinds, open window (if capability exists)
H. *Ventilation System/Air Quality* – ducting, vents
I. *Wayfinding* – ward signage, patient room signage, examples of graphical signage, signage in reference to corridor location
J. *Control* – privacy curtain, location of intercom/telephone in reference to patient bed
K. *Positive Distractions* – television, audio system, views of nature accessible to staff/patient, staff tea room/personal area, patient/visitor communal/tea room
L. *Sanitation/Cleanliness* – handwash facility (sink, en-suite sink, remote station, etc.), patient toilet, handicap access patient toilet, patient shower, handicap access patient shower, themed handwash postings

4.5.5 Quantitative Health Indicators

As previously mentioned, the availability of quantitative health indicators will vary from location to location. However, there are a few guidelines that can be considered when trying to gather this information. In general, these data should be gathered for the past six months in both old and new facilities.

A. *Length of stay* – this measure is typically the easiest quantitative health indicator to gather. Hospitals typically report this information on a ward-basis and it should be available from the "Information Services" department. If possible, it is useful if the average length of stay information is available on a month-by-month basis, along with the average patient age for each month.

B. *Administration of pain medication* – hospital pharmacies may be able to provide detailed distribution of drugs to each ward. Although they likely will be unable to

know exactly when the medications were administered, they will know what was dispensed from the pharmacy to the ward over certain time periods.

C. *Incidence of nosocomial infection* – this information may be available from the hospital's Infection Prevention department. These data are likely the hardest information to collect, because incidence of nosocomial infection is a complex measure of performance which hospitals often try to keep confidential.

4.6 DATA ORGANISATION

After data have been collected from the hospital site, they should be compiled and organised electronically using the tools provided. After these procedures have been completed for both before and after hospital visitations, the data will be available for comparison and analysis. Methodology for the analysis of data is not included in this report.

Note – Before entering data into the provided electronic organisation tools, they must be copied from the CD-ROM to a local directory on a personal computer. Running the database or spreadsheet from the CD-ROM will not work; the data will not be saved!

4.6.1 Patient and Staff Satisfaction Survey Data Compilation

Data entry and analysis of both staff and patient satisfaction surveys is facilitated by a database created specifically for this purpose, as found on the included CD-ROM. Within this database exists a form reflective of the content and organisation of each survey, allowing the researcher to efficiently enter the data for each type of survey. Upon completion of data entry, queries can be written that, upon execution, effectively present the desired data in an organised format. Output of these queries can be copied and pasted into a spreadsheet, allowing for comparison of pre- and post-renovation data.

Entry of patient and staff satisfaction survey data can be completed by following the steps below:

1. Open the file Survey_Database.mdb
2. Click on the Forms tab on the left side of the window that appears.
3. Double-click either Patient Satisfaction Survey or Staff Satisfaction Survey, depending on which data are being entered (see Figure 2).
4. The data for each survey can be entered using the provided forms; questions appear in the form of drop-down menus, text-box typing, or tick boxes.

5. For example, in the screen shot shown in Figure 3, the drop-down menu can be used to select the age group of the patient; a user can select the options Under 20 years, 20-40 years, 41-60 years, or Over 60 years.

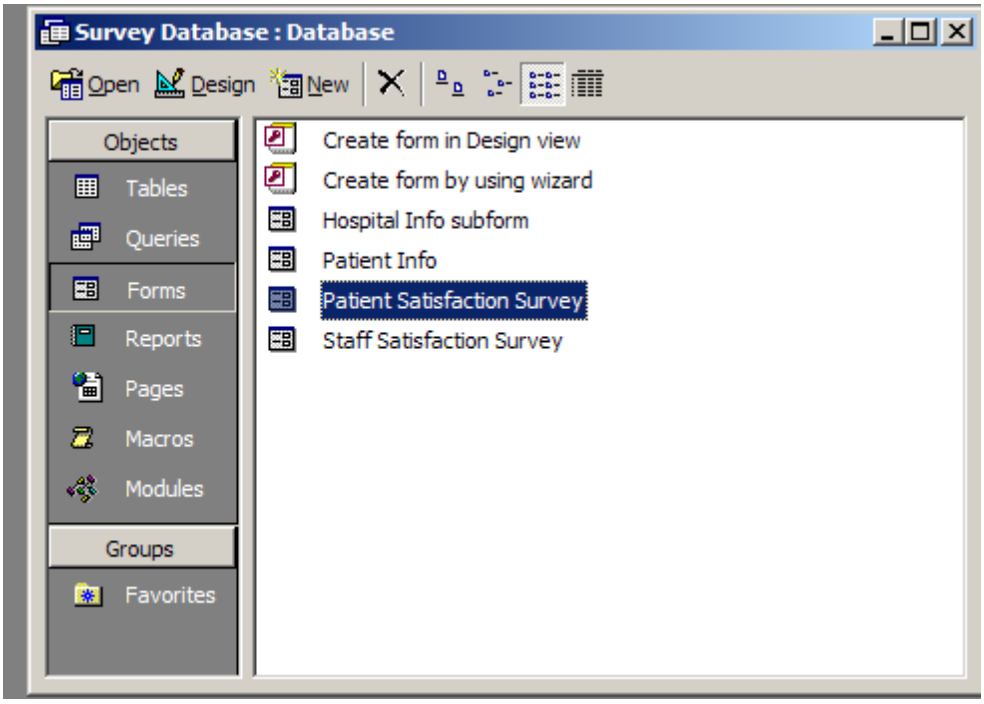

Figure 2: Selection of patient or staff databases

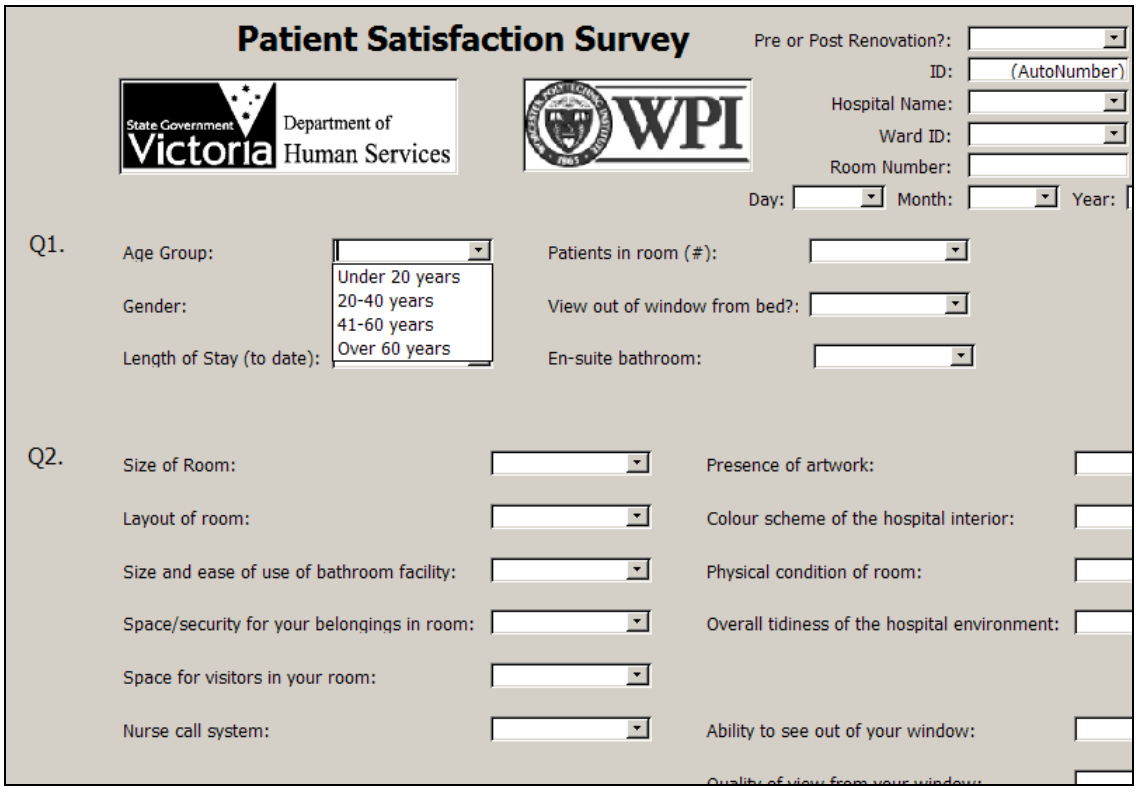

Figure 3: Database entry form for patient satisfaction survey

Once the results for one survey have been entered, advancing to a new blank record can be achieved by clicking the  button located at the bottom left of the screen; this action will save the previously entered form as well.

4.6.2 Query Development for Satisfaction Surveys

Questions contained in the patient and staff surveys were divided into categories of the built environment. In order to facilitate analysis of patient and staff satisfaction survey data, queries (a form of database lookup) written for this specific purpose can be utilised. Using these queries, spreadsheets can be generated that represent each of these themes: aesthetics, cleanliness, control, flooring, lighting, noise, positive distractions, room size, ventilation, ward layout, wayfinding, and windows. From these spreadsheets, the responses of every survey can be condensed into a spreadsheet according to theme, and analysis of means and standard deviations can take place to summarise these data.

Analysis of patient and staff satisfaction survey data can be completed by the following steps:

1. Open the file Survey_Database.mdb
2. Click on the Queries tab on the left side of the window that appears (see Figure 4)
3. To show all records for a query:
    a. Choose the query to be run, and **double-click** on its name
        i. For example, in Figure 4 the query entitled Patient – Cleanliness is being selected
    b. Double-clicking on the query causes it to execute, and the screen that appears, as shown in Figure 5, is the resulting spreadsheet of the query that shows all records

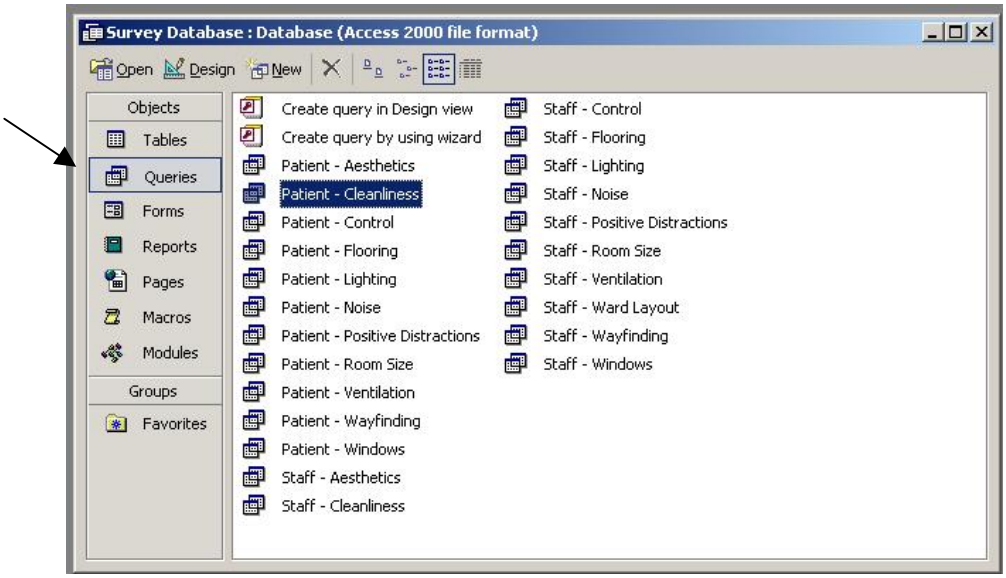

Figure 4: Selection of queries

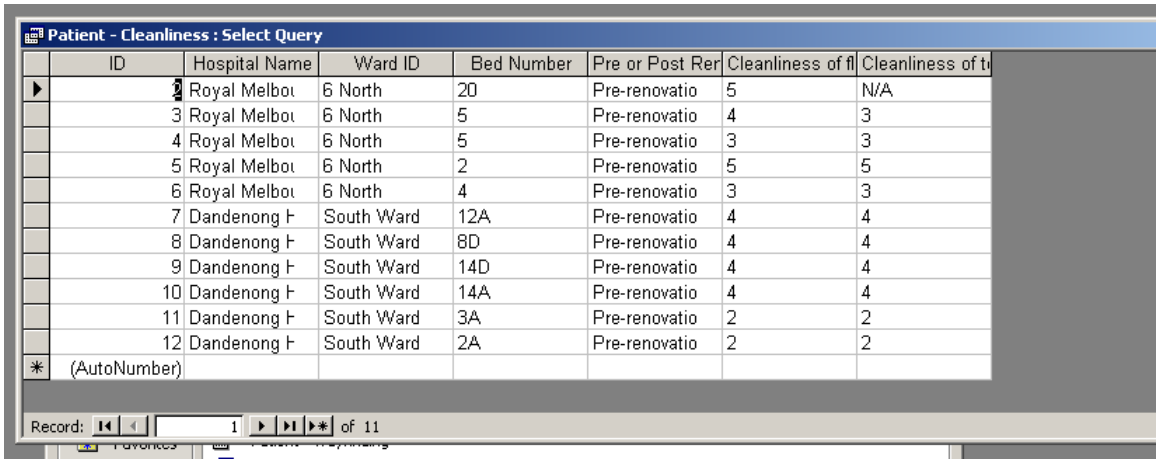

Figure 5: Execution of query

1. To show selected records for a query:
    a. Choose the query to be run, and **single-click** on its name
        i. For example, in Figure 6, the query entitled Patient – Cleanliness is being selected
    b. Click the Design button, located at the top left of the window (see Figure 6)
    c. The Design view of a query is shown in Figure 7, and from this view, filtration of the requested query can occur
        i. For example, in order to select patients from the Dandenong Hospital:
            1. From Design view, in the column of the field which is to be filtered, type the desired phrase in the Criteria row, noted with an arrow in Figure 7
                a. Type “Dandenong Hospital” in the Criteria row of the Hospital Name field, as shown in Figure 8
            2. Upon completion of this criteria entry, execute the query by clicking the  button at the top of the window, as shown in Figure 9
            3. When the query is executed, another spreadsheet will appear with only the desired records; in this case, only records present for Dandenong Hospital will appear, as shown in Figure 10

2. Any table generated by a query can be copied and pasted into Microsoft Excel, from which the data can be analysed for statistical significance, such as mean and standard deviation.

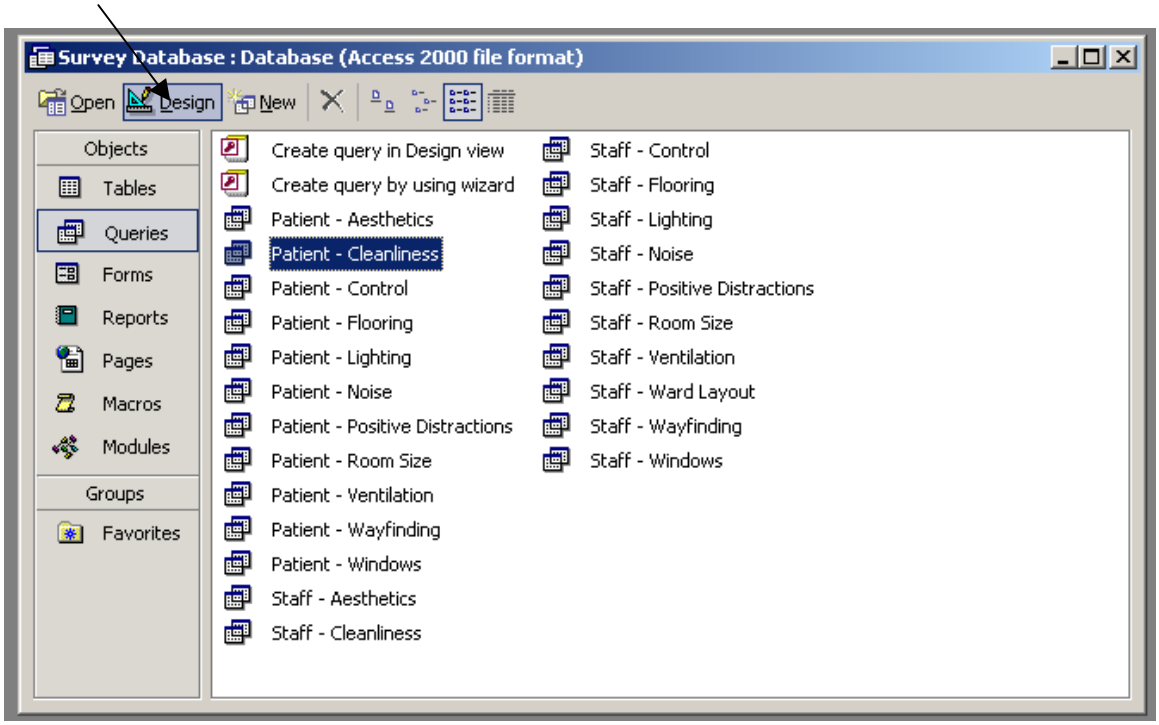

Figure 6: Selection of query and design view

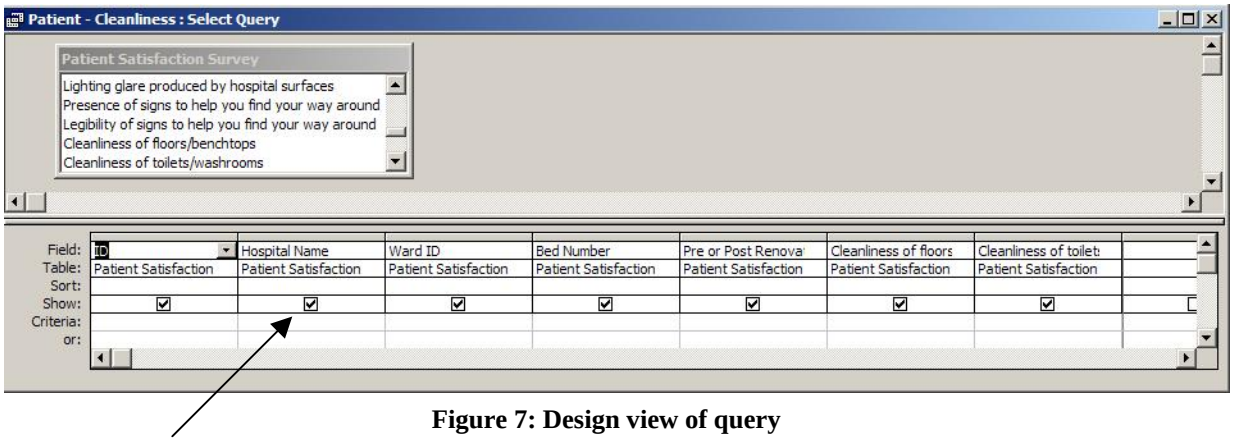

Figure 7: Design view of query

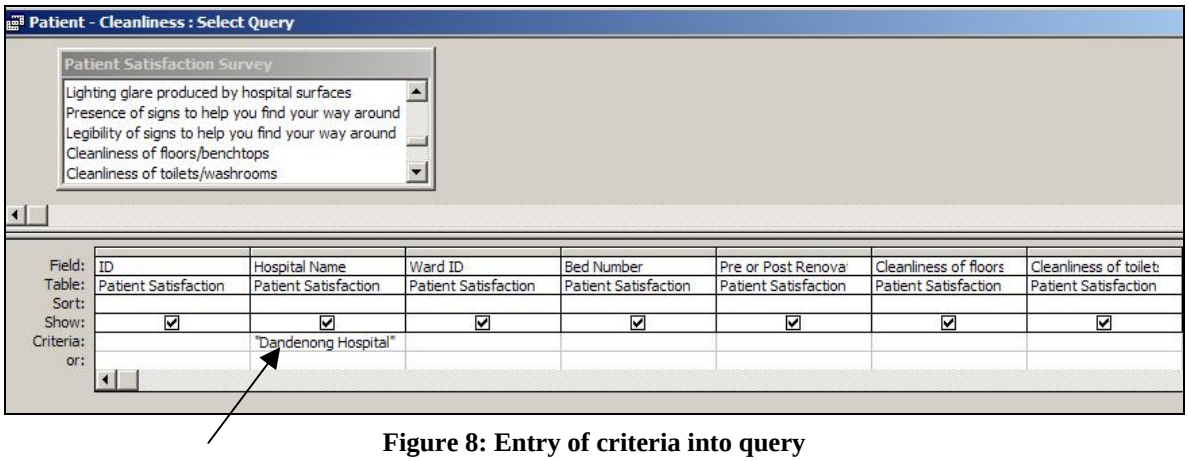

Figure 8: Entry of criteria into query

Figure 9: How to execute query

Patient - Cleanliness : Select Query

ID	Hospital Name	Ward ID	Bed Number	Pre or Post Re	Cleanliness of	Cleanliness of
7	Dandenong H	South Ward	12A	Pre-renovatic	4	4
8	Dandenong H	South Ward	8D	Pre-renovatic	4	4
9	Dandenong H	South Ward	14D	Pre-renovatic	4	4
10	Dandenong H	South Ward	14A	Pre-renovatic	4	4
11	Dandenong H	South Ward	3A	Pre-renovatic	2	2
12	Dandenong H	South Ward	2A	Pre-renovatic	2	2
(AutoNumber)						

Figure 10: Result of query execution

4.6.3 Building Evaluation Tool

After the building evaluation has been completed, the findings should be transferred to an electronic form. The data organisation tool that works in parallel with the building evaluation tool is a spreadsheet document. With this tool, the same categories assessed by the building evaluation tool are divided and listed in the same order. The tool is designed for electronic completion, allowing for ease of statistical assessment. Areas exist at the top of the spreadsheet for the input of the facility's name and ward identification, as well as the dates of both pre- and post-renovation evaluation. The spreadsheet then progresses vertically downward, starting with elements included in the ward's profile and ending with sanitation/cleanliness. The tool itself is designed to enable easy side-by-side comparison of data sets for a single facility.

Input of Data. As with the building evaluation tool itself, the data organisation tool includes four main types of questions – selection, manual input, YES/NO, and rating (1 – 5). However, the data organisation tool allows for easy electronic input of data, condensing two sets of building evaluation data into one easy-to-read spreadsheet.

- Selection question input calls for the user to access a multi-item pull-down menu and make the corresponding selection from a list of set options. Figure 11 is an example of a selection question
- YES/NO question input calls for the user to access a two-item pull-down menu and select between the YES option and the NO option. Figure 12 is an example of a YES/NO question

- Rating question input calls for the user to access a five-item pull-down menu and select the corresponding numerical value (1 – 5). Figure 13 is an example of a rating question
- Manual question input calls for the user to enter a numeric value. Only values greater than or equal to zero should be entered. Figure 14 is an example of a manual input question

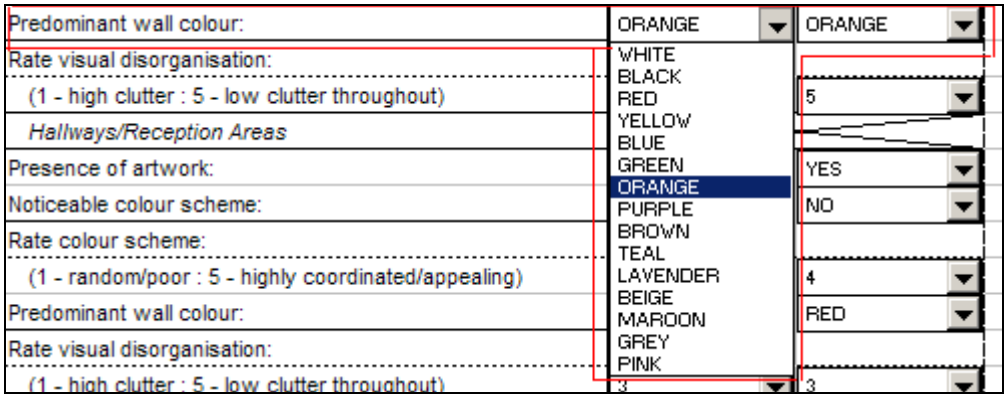

Figure 11: Building evaluation data input (selection)

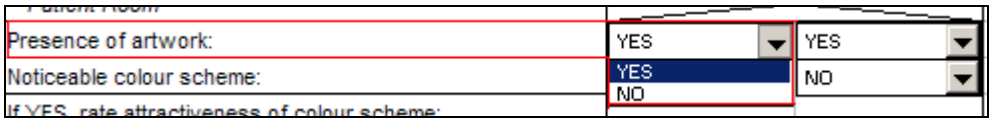

Figure 12: Building evaluation data input (YES/NO)

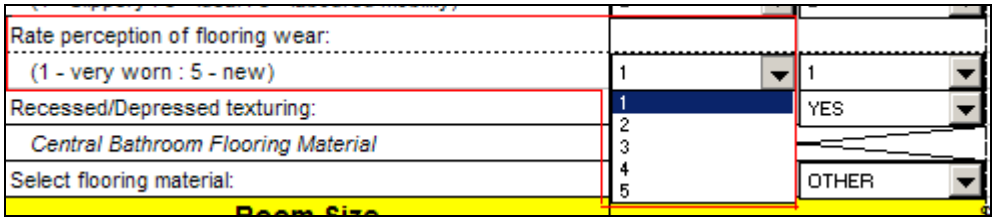

Figure 13: Building evaluation data input (rating)

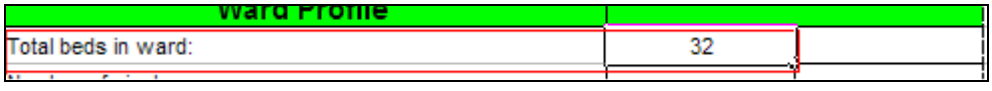

Figure 14: Building evaluation data input (manual entry)

Potential for Data Set Comparison. The organisation tool for building evaluation data has been designed for the side-by-side comparison of pre- and post-renovation data. The pre-renovation column for data entry is located immediately next to the post-renovation column –

labels for the two columns can be found at the top of the spreadsheet. The two light green columns to the right of the post-renovation column (**E** and **H**) hold the corresponding numerical values for all manual, YES/NO, and rating questions. The light blue columns to the right of these green columns (**I** and **J**) hold the corresponding numerical values for all selection questions. A screenshot of the column headings is shown in Figure 15.

- Values in **D** and **G** are direct pull-down menu output, and affect columns E and H.
- Values in E and H are more than numeric values, also containing formulas.
- Values in **K** and **L** are referenced in selection-type questions.
- Values in **M** are referenced *throughout the spreadsheet*; changing these values would negate much of the document's formulas.

Note – Columns E and I correspond to the pre-renovation data set (column **B**).
Columns H and J correspond to the post-renovation data set (column **C**).

A	B	C	D	E	F	G	H	I	J	K	L	M
Hospital - <**name here**> *Ward ID* - <**ID here**> *Ward Type* - <**ward here**>	Pre-Renovation Date of evaluation: (##/##/####)	Post-Renovation Date of evaluation: (##/##/####)										
Ward Profile												YES
Total beds in ward:				0			0					NO
Number of single rooms:				0			0					1

Figure 15: Column headings

1. Data input for selection questions appears in columns I and J. Although the output of these values appear as integers, the selection options corresponding to the various number values are commonly located to the right of the question in columns **K** and **L**.
   Example:

Ward Aesthetics										1	WHITE
Patient Room										2	BLACK
Presence of artwork:	YES	YES	1	1		1	1			3	RED
Noticeable colour scheme:	NO	NO	2	0		2	0			4	YELLOW
If YES, rate attractiveness of colour scheme:										5	BLUE
(1 - random/poor : 5 - highly coordinated/appealing)	1	1		1			1			6	GREEN
Predominant wall colour:	ORANGE	BLUE						7	5	7	ORANGE
Rate visual disorganisation:		WHITE								8	PURPLE
(1 - high clutter : 5 - low clutter throughout)	5	BLACK		5			5			9	BROWN
Hallways/Reception Areas		RED								10	TEAL
Presence of artwork:	YES	YELLOW	1	1		1	1			11	LAVENDER
Noticeable colour scheme:	NO	BLUE	2	0		2	0			12	BEIGE
Rate colour scheme:		GREEN								13	MAROON
(1 - random/poor : 5 - highly coordinated/appealing)	4	ORANGE		4			4			14	GREY
Predominant wall colour:	RED	PURPLE						3	3	15	PINK
		BROWN									
		TEAL									
		LAVENDER									
		BEIGE									
		MAROON									

Figure 16: Building evaluation data comparison (selection)

The current selection-style question is outlined in **RED**.
Its output location is circled in **YELLOW**/**GREEN**.
The correspondence between the numeric value and the option is found in the **BLUE** box.

2. Direct data output for YES/NO questions appears in columns **D** and **G**, which are hidden. They can be accessed by selecting columns to the right and left of them (**C**-H), right clicking, and selecting "Unhide." This action will allow viewing of hidden columns **D**, **F**, and **G**. Selecting YES initially returns a value of 1, while selecting NO returns a value of 2. These values are edited in columns **E** and **H** so that YES returns a 1 while NO returns a 0 (values more conducive to both statistical analysis and computer programming languages). Accordingly, the formulas in columns **E** and **H** for YES/NO questions *should not be altered*!

Example:

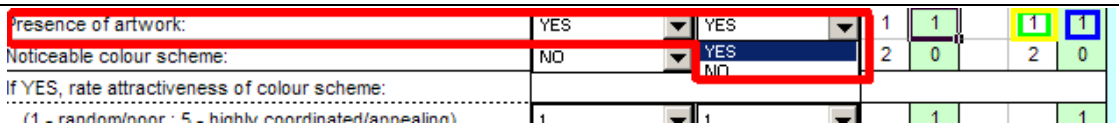

Figure 17: Building evaluation data comparison (YES/NO)

The current YES/NO question is outlined in **RED**.
The direct output (hidden) is found within the **YELLOW**/**GREEN** box.
The value made visible to the use is found within the **BLUE** box.

3. Data output for rating questions appears in columns E and H of the spreadsheet. The output in visible in the pull-down menu is the same as the output found in the corresponding row of either column E or H. This repetition is carried out because a numeric value contained in an individual cell is much easier to manipulate for purposes of analysis than a numeric value found in a pull-down menu box.

Example:

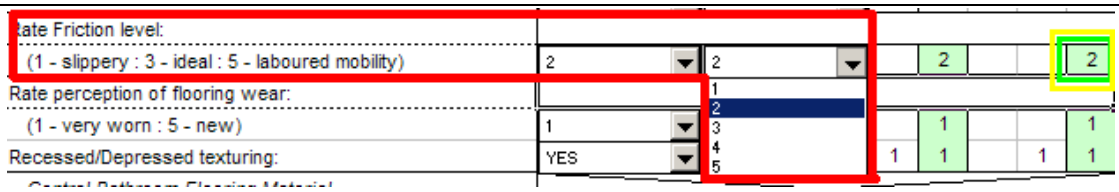

Figure 18: Building evaluation data comparison (rating)

The current rating question is outlined in **RED**.
The out visible to the user is found within the **YELLOW**/**GREEN** box.

4. Data output for manual input questions appears in columns E and H. This formatting has been done so that all non-selection style output values appear in the same columns, allowing for quick and easy visual analysis.

Example:

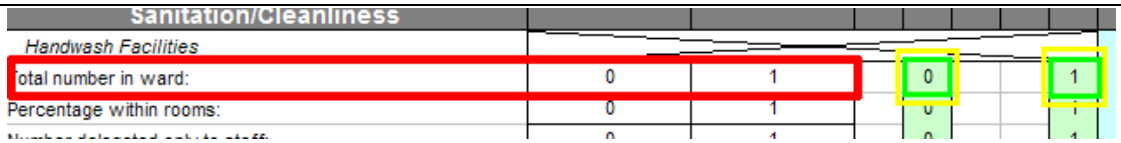

Figure 19: Building evaluation data comparison (manual entry)

The current manual input question is outlined in **RED**.
The output visible to the user is found within the **YELLOW**/**GREEN** box(es).

4.6.4 Composition of Built Environment Narratives

If different research teams complete the pre- and post-renovation studies, the validity of results and conclusions relies upon the ability to present the condition of the ward environments. Because there may be an extended period between the two evaluations (due to planning, construction, etc.), it is important that an accurate and detailed description of pre-renovation facility exists. This written narrative should serve to describe the existing environment, "painting a mental picture" for easy post-renovation identification of all relevant changes to the environment.

Format. The format of this narrative, for clarity and ease of comparison between numerical data and descriptive prose, should follow the general format and order of the building evaluation tool. The building evaluation tool itself serves as the primary reference when writing the narrative – all information from the analysis tool should be included. The individual headings utilised by the evaluation tool double as headings for this writing. It is important to note that composition of the narrative requires a mixture of all-text paragraphs and bulleted lists of information. Certain statistics gathered by the tool will lend themselves to a list, while others will require text for adequate explanation. Examples are provided in Appendices C and D.

Descriptive writing. The building evaluation tool contains five basic types of questions – YES/NO, manual input, selection, write-in (non-numeric), and rating. It is simple to convert a YES/NO, selection, or manual (numeric) input response into text. For this reason, one may find that closely related groups of these types of questions lend themselves to bulleted listing (e.g., four questions in succession requiring the calculation of allocated ward space as a

percentage of the entire ward). Rating questions are much more complicated. It would be flawed to rate a flooring friction level as 2 out of 5, without a description of the significance of this rating. A future study would not understand the context of this statement/scoring. Clarification of such questions is necessary for such observations to be useful during post-renovations analysis.

Inclusion of Pictures. In the case of the descriptive narrative, pictures should supplement the written prose. YES/NO questions may warrant specific pictures (e.g. patient security and a picture of a lockable cabinet, individual lighting and a picture of an adjustable overhead lamp, etc.). Pictures of entire rooms (staff tea room or patient room) should flow intuitively (moving from left to right or vice versa), allowing the reader to visualise a room in its entirety. One will find it more difficult to include layout photos of the facility (e.g. orientation of beds in a quad, staff base in relation to patient rooms, etc.), as the ward will more than likely be busy and patients are not to be included in pictures.

4.6.5 Quantitative Health Indicators

As discussed in Section 4.5.5, each hospital will have its own procedures for reporting on the quantitative health indicators (length of stay, levels of administered pain medication, and incidence of nosocomial infection) and at certain locations, some of these items will not be available. For these reasons, methods of organisation and presentation of quantitative health indicators are left for the researcher to determine, as appropriate. However, these data should be reported in such a way that they are suitable for comparison between before and after renovations are made. In most cases, it may seem appropriate to compile a table of monthly averages for the previous six months with an overall average below. In addition, it may prove useful to present the monthly average age of patients in the ward with each health indicator.

4.7 CONTENTS OF CD-ROM

The organisation and contents of the included CD-ROM can be seen on the next page. Folders are bold and represented with (↳); files are represented with (⇢). Each file has a corresponding description listed in italics.

Filename	*Description*
↳ **Organisation Tools**	
⇢Building_data_organisation.xls	*Spreadsheet for entering results of building evaluation.*
⇢Survey_database.mdb	*Database for entering results of patient and staff surveys.*
↳ **Surveys and Assessment Tools**	
↳ **Building Evaluation**	
⇢Building_evaluation_tool.pdf	*Forms for evaluating the ward environment.*
↳ **Satisfaction Surveys**	
⇢Patient_cover_sheet.pdf	*To be attached in front of the patient survey.*
⇢Patient_question_categories.pdf	*Itemised listing of the categories for each question of the patient survey.*
⇢Patient_satisfaction_survey.pdf	*Patient satisfaction survey.*
⇢Staff_cover_sheet.pdf	*To be attached in front of the staff survey.*
⇢Staff_question_categories.pdf	*Itemised listing of the categories for each question of the staff survey.*
⇢Staff_satisfaction_survey.pdf	*Staff satisfaction survey.*
⇢Built_environment_patients_staff.pdf	*Entire report for this project.*
⇢User_manual.pdf	*This User's Manual.*

5 Conclusions and Recommendations

In this chapter we present a summary of the goals, procedures, and products of the methodology that we created in order to investigate the effects of the built environment on patient health outcomes and staff satisfaction. We also assess the efficacy of each component of the methodology revealed by piloting our methodology in two existing healthcare facilities. Based on this evaluation, we make recommendations regarding how the content and administration techniques could potentially be improved in the future. These suggestions are derived from our experience; other options for improving the methodology may exist. Researchers completing the follow-up study should use caution when implementing these changes if they wish to have a second set of comparable data; however, if an additional study attempts to use this methodology to collect data in healthcare facilities before and after renovations, it should take all of these recommendations into consideration.

5.1 SUMMARY

The intent of this project was to create and implement a methodology that would enable empirical assessment of the built environment of a healthcare facility and its effects on patient health outcomes and staff satisfaction. We were able to devise this methodology through a review of literature examining a possible link between the physical setting of a hospital and patient health outcomes and staff satisfaction, focus groups and interviews with CMB personnel, and preliminary site visits to hospital facilities under consideration for investigation. Following its development, this methodology was implemented for the purpose of baseline data collection in existing adult acute inpatient medical wards at two hospitals within the metropolitan area of Melbourne, Australia: the Royal Melbourne Hospital and the Dandenong Hospital. We developed a framework for a follow-up study to be completed by another research group in early 2006, twelve months after the collection of baseline data. The data collected from this follow-up study is to be analysed and compared to our baseline data to test for differences. Completion of this study may provide DHS with empirical evidence corroborating the link between the built environment and its effects on patients and staff, substantiating decisions to fund healthcare refurbishment projects.

The methodology was developed to support analysis of five major outcome measures: incidence of nosocomial infection, amount of administered analgesics, average length of patient stay, patient satisfaction, and staff satisfaction. We designed and administered surveys to assess patient and staff satisfaction with the built environment. The particular environmental factors addressed in these surveys were determined by the findings from our literature review, interviews and focus groups with CMB personnel, and feedback from

hospital staff during our preliminary site visits. Two of the three quantitative health indicators were obtained through consultation with appropriate personnel at each hospital. A building evaluation tool was designed and employed within our methodology to enable objective comparison of the environments of healthcare facilities before and after renovations, allowing different outcomes to be linked to environmental differences.

The data collected from each of the surveys were aggregated in the form of a database created specifically for this purpose, allowing for ease of data entry, access, and analysis. Information gathered using the building evaluation tool for each facility was entered into a spreadsheet, and we wrote detailed descriptions of each based on these observations. We organised the quantitative health indicators into appropriate spreadsheets to efficiently transmit the baseline data to the group performing the follow-up study. Upon completion of data collection and organisation, we developed a user's manual to facilitate completion of the follow-up study that describes effective execution of our methodology.

5.2 INITIAL ASSESSMENT OF THE METHODOLOGY

Through consultation with numerous individuals at each hospital and the Department of Human Services, we were able to complete our project in such a way that opinions and facts gathered from these individuals were taken into consideration. The patient and staff satisfaction surveys, building evaluation tool, and quantitative health indicator extraction measures were created so that data collection, organisation, and analysis could be efficient at both baseline and follow-up. The result was a tool that could be used to assess the effects of the environment in acute adult inpatient medical wards. Upon implementation of the methodology, we found that some of its components were effective, whereas others revealed areas for improvement both in content and administration techniques. This initial assessment of the methodology results from the findings of its piloting, which also served as a collection of baseline data.

5.2.1 Patient Satisfaction Survey

The patient satisfaction survey is a tool used to assess a patient's satisfaction with the built environment of his or her room and ward. It was developed in such a way that we included a wide range of aspects of the built environment, and this comprehensive nature allowed us to ask patients many different types of questions and gather a great deal of information regarding their perceptions of their accommodations. Although this survey encompasses numerous aspects of the physical setting of the hospital, its content was restricted by the amount of time patients are typically willing to invest in a survey. We were able to create

tools that assessed fundamental aspects of the built environment, but were forced to exclude certain elements mentioned in our interviews and focus groups.

We chose face-to-face interviews as our primary technique the patient survey administration. This method enabled us to note any additional comments that the patients may have regarding their satisfaction with the hospital facility. However, this technique presented difficulties that should be taken into consideration for the collection and analysis of follow-up data. Ward 6 North at the Royal Melbourne Hospital is primarily an elderly acute care ward, and interviewing patients in this ward was a challenging task. The general nature of the ward, along with the age and cognitive function of its patients, created problems with survey administration and data collection. Although we were referred to patients who demonstrated appropriate cognitive function, they did not necessarily articulate their opinions of the built environment as proficiently as we would have anticipated. Patients often failed to quantify their responses on the Likert scale, creating the need for researchers to interpret how the opinion of the patient applied to the scale or omit the data. Language barriers further complicated communication between the patient and researcher, sometimes making survey completion difficult. Other issues that arose during patient survey administration included both the willingness and availability of patients to complete the survey. Patients were often confused as to why we were completing the survey; a patient at the Dandenong Hospital stated, “I’m not here on holiday, I’m here to get better.” At other points during our data collection, we found that patients were often unavailable because they were sleeping, visiting with family and friends, or eating meals. As a result, we gathered two to four surveys per visit to each hospital. We would have preferred to administer ten or more of these surveys per ward.

In terms of content, we discovered that there were a few relevant topics not included in our survey. For example, many patients expressed their dissatisfaction with mixed gender rooms and their associated awkwardness. We also found that the format of the survey could be altered to both make it more conducive to an interview format and create a more cohesive, thematic flow of information rather than question format. Questions in the survey were organised by their response type, as we originally developed the survey for patients to fill out themselves. Therefore, the interviews became slightly awkward and confusing for patients as topics were presented in a somewhat disjointed manner. Recommendations for addressing these concerns will be discussed in Section 5.3.

5.2.2 Staff Satisfaction Survey

The staff satisfaction survey enabled us to gather information regarding the staff members' perceptions of the built environment as it affected their abilities to deliver services to patients, personal satisfaction, and their perceptions of patients' opinions of the environment. This survey was designed to gather a considerable deal of information in a relatively short amount of time because staff members are often busy throughout the course of a day. We had anticipated that we would be able to administer the staff surveys face-to-face, using a technique similar to that of the patient survey administration. We realised that this method was not feasible due to staff member availability during the day and an inability to collect data from multiple shifts. Therefore, we requested that all staff members complete the survey individually in order to have a consistent method of survey administration.

Through consultation with the nurse unit managers of each ward, we decided to have the staff members complete the surveys at their convenience and return them at our next visit. Such a technique allowed us to survey two staff members on the morning, afternoon, and night shifts. The nurse unit manager advised that we survey a variety of shifts, as staff members on each shift can offer a different perspective of the ward environment. In these surveys, no question existed that gathered information about which shift the staff member completing the survey worked. Such a question would have provided valuable information regarding different conditions present in the ward during each shift.

Despite the assurance that staff would be compliant with survey completion, we were still concerned with surveys being misplaced, as well as the possibility of staff members having questions regarding survey content that we would not be present to answer. We received five completed surveys out of six given at the Royal Melbourne Hospital Ward 6 North, and four out of six given at the Dandenong Hospital South Ward. We were pleased with this response rate, but had hoped for six surveys per facility.

5.2.3 Quantitative Health Indicators

Acquisition of the quantitative health indicators of incidence of nosocomial infection, length of patient stay, and analgesic usage from each facility presented the greatest challenge. These key hospital performance indicators are difficult to obtain, as they are often kept confidential since they may influence the image of a hospital. We were required to obtain approval from many different administrative departments before we were able to gather any of this information, which consumed a significant amount of time. However, upon consultation with appropriate departmental personnel in each hospital, we were able to acquire data about the average length of stay and levels of administered analgesics.

The Information Services or Information Technology departments at each hospital could retrieve the information on average length of patient stay by running simple queries, which provided us with information regarding average patient age, number of discharges for the ward, and average length of patient stay over the past six months. A potential issue for the follow-up study with this acquisition method is that many different queries could be used to gather this information, so there is a risk that two separate queries could be used to obtain length of stay information before and after renovations. This inconsistency would result in differences in the length of stay that were reflective of different queries rather than different environments. In addition, our contact at Royal Melbourne Hospital advised us that there would be many other factors influencing the length of stay information. For example, DHS is currently working on a Patient Flow Collaborative program to limit the unnecessary bedtime that patients consume while waiting for other services such as x-rays, operations, or discharge. These efforts could be responsible for future decreases in average length of stay, confounding the effects of the built environment renovations.

The usage of analgesics data could be obtained from the pharmacy department of both the Royal Melbourne and Dandenong Hospitals. The Pharmacy Coordinator at the Royal Melbourne Hospital, Nicholas Jones, helped us to understand the complexity of reported drug administration data. He informed us of the fact that simply reporting Schedule 4 versus Schedule 8 drugs does not provide a clear indication of all analgesic usage in the ward. Schedules are only used to indicate potential for misuse, and not all common analgesics will fall into either of these two categories. Therefore, he provided us with the usage data of the varying dosages of six common analgesics: morphine, oxycodone, paracetamol, panadeine, panadeine forte, and tramadol. He felt that these data would allow us to gather a more accurate survey of analgesic usage, rather than restricting the reported medications to Schedules 4 and 8. In addition, he advised that the data might be skewed by a number of factors, including individual patients that develop a tolerance to the stronger analgesics and require higher dosages over time. Reporting the data on a monthly basis should draw attention to unusually high or low usage levels. Maggie Emmerton of the Dandenong Hospital Pharmacy provided us with similar data regarding analgesic usage for South Ward. The medications reported were aspirin dispersible, paracetamol, tramadol, codeine, morphine slow release, and morphine sulfate. We also applied the advice of Nicholas Jones to the data acquired from the Dandenong Hospital. Acquisition and interpretation of these data were relatively simple following receipt of hospital approval. The amount and scope of this information may permit the usage of statistical tests upon follow-up data collection, as changes in analgesic usage could be useful in determining the statistical significance of environmental renovations.

We were unable to obtain information regarding the incidence of nosocomial infection from either hospital. Nosocomial infection rates are difficult to determine and may not be technically appropriate to assign at a ward level. Dandenong Hospital did not pursue providing this information, simply explaining that it was too complex for the nature and timeline of our project. The Infection Prevention and Surveillance Services at Royal Melbourne Hospital was not convinced that the effects of the built environment were influential enough in a general medical ward to release these confidential data. According to Cindy Grieve, Clinical Nurse Consultant, "due to the many variables associated with developing a nosocomial infection and the complexity of the patients on ward 6 North [they were] not satisfied that the data [were] robust enough to be included in this project."

5.2.4 Building Evaluation Tool

We designed and implemented the building evaluation tool in order to collect and present a comprehensive description of the ward environment at both baseline and follow-up. The tool was effective in doing so, as it enabled us to develop such a description that would allow follow-up researchers to gain an accurate and thorough perspective of the relevant built environment characteristics of the existing ward. Therefore, these researchers would be able to effectively document the changes made to the ward during its renovation or construction and perform analysis to link certain changes with observed study outcomes.

The building evaluation tool, though it addresses many aspects of the built environment, also has limitations. It relies on both objective measurements and subjective interpretations based on researcher observation. As a result, differences in observation may occur between researchers completing the evaluation. Although a rubric is presented for most measures in an attempt to limit such discrepancies, researcher judgment may weigh heavily on data collection. In addition, these rating scale questions are each specific to some aspect of the built environment, and do not allow for a consistent rubric to apply throughout the tool.

Lux and decibel meters, instruments used for documenting the light and noise levels, were unavailable for our project on such short notice. The engineers at Dandenong Hospital provided us with previously measured levels, but the lighting conditions noted in our building evaluation for Royal Melbourne Hospital were based on qualitative observations. Actual, repeatable measurement of these levels would have been advantageous to the documentation in our project.

5.2.5 Organisational Tools

Upon collection of baseline data, we entered these data into our previously created organisational tools. Despite the fact that these tools were effective in organising and presenting the data, we discovered areas for improvement. The satisfaction survey database does not have spaces in which to enter patient or staff comments mentioned in interviews or written on the actual survey. These comments are available on the paper copies of the surveys, but having them available electronically may be very helpful to researchers. Although using the spreadsheet to organise the building evaluation data presents this same problem, additional comments are taken into account when writing building narratives.

5.3 RECOMMENDATIONS FOR FOLLOW-UP STUDY

In early 2006, approximately one year from the completion of this report, a follow-up study should be carried out to collect data from the two wards after they have been renovated. This follow-up will be completed by a different group of researchers who will be comparing their collected data to the pre-renovation baseline data that were collected as a part of this project. From this comparison, they should be able to assess the impact of healthcare facility renovation on patient health outcomes and staff satisfaction.

It is recommended that the next group of researchers, as part of their background research, familiarise themselves with the methodology and procedures of data collection which they will need to carry out to effectively complete this collection. Careful consideration should be given before altering these tools or administration techniques. Although recommendations included in this section could potentially improve the efficiency of the methodology, comparing data which were collected using different tools or techniques could produce invalid results.

In addition, the follow-up group should not rely solely upon the comparison of pre- and post-renovation data as collected from the building evaluation tool and reported in the provided organisational spreadsheet. The researchers are encouraged to read the narrative descriptions of the built environment provided in Appendix C and Appendix D in order to ensure that the researchers have an understanding of the older hospital environments. The narratives include information which cannot be conveyed strictly through numerical analysis, and provide an understanding of what we were able to gather through observation, as well as any additional comments.

Paper copies of the surveys and building evaluation tools that were gathered during the baseline data collection are available from the CMB Asset Information Manager, Judith

Hemsworth. The original paperwork for the patient and staff surveys and building evaluation tool is organised by hospital location. Along with these raw baseline data, hospital and ward specifics such as administrative contacts, floor plans, etc. are also available from Ms. Hemsworth.

The follow-up research group should be prepared to interact with a variety of patients, many of whom may be disoriented. In particular, the ward studied at the Royal Melbourne Hospital is an elderly care ward where many of the patients did not demonstrate sufficient cognitive ability to complete a survey. Adequate time must be planned for administering the surveys, as more than two visits may be necessary to obtain a suitable number of completed responses. The user's manual recommends surveying at least ten patients; however, we were unable to collect this number due to the short timeline and unavailability of patients. During most hospital visits, only two to four patients in each ward were suitable for survey completion; this limitation should be taken into consideration when planning data collection visits (see user's manual in Chapter 4).

In terms of patient satisfaction survey content, we discovered that a few of the questions could be omitted, as they either did not apply, or patient responses led us to believe that these factors were not important to satisfaction. For example, questions regarding level of social interaction, entertainment activities, presence of glare, and presence of artwork were not easily comprehended by patients. We found that patients usually choose not to interact with other patients, and that hospitals do not offer entertainment activities for their inpatients. Presences of glare and artwork could be incorporated into the building evaluation tool. Therefore, future researchers may opt to omit these four questions from the patient satisfaction survey. A topic that could be added at the discretion of the researcher is that of mixed gender rooms; patients can be asked about their satisfaction, or lack thereof, with this feature.

If researchers wish to alter the format of the patient satisfaction survey so that it is more conducive to an interview in the sense that the information is organised by environmental variable, we recommend that questions four and five of the patient satisfaction survey be incorporated into their appropriate categories, separating the Likert scale rating questions. Question four, which deals with views, could be placed with associated rating questions. Question five, addressing noise, can be placed with other questions regarding noise. Reorganising the survey in this manner may make it easier for the patient to grasp, as themes are presented rather than question formats.

Staff satisfaction is a complex issue that is influenced by many factors. Among these factors are ward administration, co-workers, quality of the environment, and patient status. When

conducting this survey, the researcher must bear in mind that other underlying issues may exist that affect the satisfaction of a particular staff member. For example, a staff member unhappy with the ward administration or nurse unit manager may be more likely to convey more negative opinions regarding their work environment.

Although we did not get much feedback on the content of the staff satisfaction survey, we suggest one minor modification. We recommend that future researchers add a question that gathers information about which shift or shifts the staff member is working. In order to improve the response rate, persons completing this study may administer the staff satisfaction surveys at multiple times in a ward, but must be careful that the same staff member does not complete a survey twice.

We highly recommend that pursuit of quantitative health indicators begin immediately after the hospital has approved the project to allow enough time to establish contacts and gather appropriate data. As previously explained, approval is required from many sources before the data can be collected, and if available it will be from different departments and in varying formats. Effective filtration of large amounts of coded data can be challenging for non-medical professionals, further complicating the process of obtaining and interpreting data. We recommend beginning this pursuit at each hospital by contacting Information Services for length of stay, the Pharmacy Department for administration of analgesics, and Infection Prevention for rates of nosocomial infection.

When the building tool is used to evaluate differences in the pre- and post-renovation environments, researchers should consider the consistency of observation and presence of bias. Future studies may benefit from adding more detailed descriptions to the meaning of each rating in order to make the building evaluation a more objective tool. The building evaluation includes many specific details which may be useful for future comparison of environments, but if a researcher requires a concise, less time-consuming building assessment it may be necessary to condense its content. The building evaluation tool could also become more time efficient if it could be filled out on-site using a handheld computer.

In order to complete the building evaluation tool in its entirety, we recommend that the next project group begin to make contacts within DHS as soon as possible to arrange for the use of noise and light meters. The source and accuracy of the readings obtained from Dandenong Hospital remain uncertain, and the actual measurements could not be acquired at Royal Melbourne Hospital. Although these metered readings are not always available from the pre-renovation environment, it may be important to include these findings in the narrative description of the new facilities, even if only as a reference for future studies.

Data organisation tools could be modified to create a more consistent means of data collection. Researchers may want to add fields or create a separate tool altogether for the entry of comments generated by patients and staff during survey administration. It may also be useful to enter past comments from the paper copies into this proposed tool for comparison.

Although we did not perform analysis of data or include tools for that purpose in the development of our framework, we briefly investigated potential methods of analysis. Topics researched included how to create surveys such that they will be effective for data analysis, and brief research on the usage of biostatistics to test for statistically significant differences in the comparison of baseline and follow-up data. An interview transcript with WPI Professor Elizabeth Ryder on the topic of biostatistics can be found in Appendix A. It would be useful for the group of follow-up researchers to spend some time learning about how and if to use principles of biostatistics to perform their analyses.

This methodology was created with Victorian healthcare in mind, but we believe that it may be more generally applicable to adult acute care inpatient wards for which the quantitative health indicators are available. If the methodology is implemented in a specialised ward, such as a paediatric or neurosurgery ward, supplementary materials and questions outside of the scope of this project will be required. The possibility for broad implementation warrants further investigation, and may result in significant implications for the impact of this work. Healthcare organisations could potentially utilise modified versions of these tools to assess the impact of renovations to the built environment of healthcare facilities, and therefore allocate funds more appropriately. As a result, quality of patient care could be improved through usage of more efficient healthcare facilities.

Appendix A: Interview Transcripts

A.1 JUDITH HEMSWORTH, PROJECT LIAISON

Date: 8/2/05, 6:00PM
Location: WPI Campus Center, Chairman's Room, via telephone
Interviewer(s): L. Baldassari, M. Conforte, C. Werner

Credentials: Asset Information Manager of the CMB and project liaison

Introduction: We began by individually introducing ourselves and providing information about what we are each studying and what some of our hobbies are. We told Judith that we are well underway with our project and have almost completed our literature review.

Q: *The project description makes it clear that there is a lack of empirical evidence to support the existing claims that quality within the built environment affects patient outcome. Whoever, we have received a "database" consisting of 50+ articles, and in a few short weeks, have located numerous sources of our own on the topic. Our group is confused as to exactly* how *there exists a lack of evidence to support such claims. Could you explain what is mean by a "lack of empirical evidence"; when you say lack of evidence, do you mean that evidence and studies have not yet been applied to the situation in Melbourne? Are you looking for specific case studies more than medical reports?*

A: Past studies have looked at critical factors, people asked for perceptions; it is hard to quantify what is usually subjective data. Now we want to do an empirical study. What can be measured? – length of stay, incidence of hospital-acquired infection (methicillin-resistant staphylococcus aureus in particular), patient satisfaction, and usage of medication (analgesics, self administered?). Departments in hospital we will need to negotiate with: quality of care department; for advice on measurements/quantifying certain measures.

Q: *By what means will we be able to acquire the information required in the methodology we devise? What information will we have access to? Medical records, hospital records, billing records, etc?*

A: We will be looking to work with the hospital to report data to us in terms of rates of HAI (and types over time), length of stay, patients in a particular ward, and interviewing these patients prior to discharge. The hospitals report their data to the DHS anyway, so we just need to figure out how to access/use this data.

Q: *What changes will be implemented during the renovations of the facilities? What are the sizes of facilities we will be assessing? Is it feasible to do a survey and/or census?*

A: We will probably be looking at an acute care hospital and/or an emergency facility; need to tailor methodology to take into account the short-term nature of this care. Plans already exist to renovate the facilities, some are under construction; improvements include increased number of single-bed rooms, increased number of handwashing facilities (to decrease HAI). We will be able to visit existing facilities

Q: *Having done some preliminary research into our topic, we are beginning to understand the issues surrounding improving Victorian healthcare architecturally. However, we do not know exactly how this particular problem, the need for a methodology backed by evidence, became a proposed WPI project. Maybe if you were to explain the factors, context, realisations, or even trends in Australian healthcare that brought about the need for architectural improvement, our background research efforts would be assisted.*

A: Australia has a public health system, which is more governmentally regulated and centralised care system than the US. It is funded through each state government. There are 140 hospitals in Victoria, and an accreditation process exists, where hospitals are inspected. The hospitals in Victoria operate under what is largely a public system, always under budget pressure, need to plan projects, set goals, and tighten to appropriately allocate resources.

Closing: Judith told us that Randall Garnham is her manager, the manager of the Strategic Planning Unit. Judith also mentioned Prof Lawson from the UK (we have read his literature) coming to Sydney for a conference in March. She said to stay in touch and welcomed us to call if we have any questions.

A.2 ELIZABETH RYDER, BIOSTATISTICIAN

Date: 10/2/05, 1:00PM
Location: SL 330 (her office)
Interviewer(s): L. Baldassari

Credentials: WPI Associate Professor of Biology /Biotechnology

Introduction: Professor Ryder and I know each other very well because I have worked for her for the past two years, so no introduction or "breaking the ice" was necessary. She requested that she not be tape-recorded.

Q: *We first had a discussion about the major tasks and purposes of the project. I had provided her with a copy of our Project Brief (as prepared by the Department of Human Services) a few days before the interview. The major tasks of the project were described as follows:*

- *Do background research on correlation between patient outcomes and built environment*
- *Interview professionals, survey sites in Australia in order to get scope of healthcare system and how we can gather certain information*
- *Develop methodology to assess certain outcome measures as designated by sponsor that are associated with built environment improvement (length of stay, medication (especially analgesic) usage, patient satisfaction, and incidence of hospital acquired infection)*
- *We will have access to hospital records (general, no names), and will be able to conduct a survey and/or census of hospital patients upon discharge*
- *Have to figure out how data will be input/analysed (database, etc?)*
- *We will then pilot our devised methodology for a facility (or two) that will be undergoing construction within the next twelve months*
- *Our task is to help them set up a means of data collection and analysis that will allow the organisation to assess whether these architectural improvements significantly improved these outcome measures, before construction and at a twelve month follow-up.*

A: In response to this, Professor Ryder brought up the concepts of discrete analysis: log linear analysis and linear regression using squared differences and the general formula y = kx +b. Together, these statistical tools have the power to

determine the effects of multiple variables on a single outcome and which explains the most significant results.

Another topic that she brought up was the Chi-square test. This test is used to determine the statistical significance of the difference between two groups of data when a relationship between them is suspected. A null hypothesis is made, usually that the proportions in each group are equal (and therefore unrelated/their probabilities of occurrence are equal). The two values, observed and expected, are used to calculate a number known as the Chi-square value, or χ^2. A special table is then utilised to calculate the p value, or probability that the recorded numbers occurred at random, corresponding to the degrees of freedom in the test (equal to the number of classes tested minus one). The smaller the p value, the greater the statistical significance of the data.

In application to our project, Professor Ryder suggested that each variable be tested separately. For example, to test the effect of single-bed vs. multi-bed rooms on nosocomial infection, we could use the Chi-square test to test the null hypothesis that the proportion of patients with nosocomial infection in single-bed rooms is equal to the proportion of patients with nosocomial infection in multi-bed rooms; or in other words, that the room has no effect on acquisition of nosocomial infection. Upon data collection and analysis using this method, the p value could be used to determine the significance in this relationship.

Q: *In terms of the preliminary statistics we gather (lit review, interviewing/surveying professionals in Australia), are there any measures we can use that can assist us in determining the relative importance of these built environment factors so that we can weight them in our methodology accordingly?*

A: She responded by saying that an analysis of variance can be used with the hypothesis that the factors have the same impact. Upon this preliminary data collection, she suggested that we could determine the most important factors to ask patients by a parametric test.

Q: *What study designs are you aware of that involve surveys about rather subjective measures (i.e. patient satisfaction)?*

A: She responded by saying that she was not an expert on survey design, as it is rather a detailed and intricate process, and suggested that we speak to Professor

James Doyle of the Social Science department at WPI who has prepared a survey design handbook.

Q: *Is it feasible for us to quantify this subjective measure in the form of surveys?*

A: Her idea was that we use a visual analogue scale in the survey, allowing patients to quantify for us their perceptions of the environment.

Q: *What sample size is sufficient (depending on the size of the facility) to prove statistical significance?*

A: When using a measure such as the Chi-square test, it is important that the proportions are significant in relation to the population of the facility.

Q: *Due to the fact that we will be working with probably two facilities (an acute inpatient ward and an emergency facility), which patients come to for a variety of reasons, would it be feasible for us to stratify this data in terms of patient condition?*

A: Yes, an analysis of variance with stratified data could be performed. Using factorial design and a two-way ANOVA, which tests for difference among the classes, this can determine which factors are more important for each class.

Q: *We will be collecting a large amount of data upon implementation of our methodology. If we decide to use a database to collect and organise our information, we will be responsible for analysis of the data as well. What statistical tests do you feel would be the most effective in the before and after analysis of this type of data?*

A: The most effective database format for this project would probably be a record for each patient, but we would need to establish a numbering system because the data we will be collecting from the hospital will most likely not contain patient identification.

- As far as tests go, the Chi-square and t tests would be the most effective with this type of data (before and after comparisons).
- Another point she addressed was that in order to accurately assess the four outcome measures, we would have to establish a control of some sort for each. For example, a control in the length of stay outcome would be grouping patients with a similar illness together and then report whether the patients were in single- or multi-bed rooms.

Q: *One of our outcome measures is the incidence of hospital-acquired, or nosocomial, infection. The DHS plans to implement architecture that is conducive to the prevention of these infections, such as increasing the number of single-bed rooms and number of handwashing facilities. Do you know of any epidemiology-related statistics or tests we could use to more effectively track their occurrence both before and after renovation?*

A: She was not familiar with epidemiology, but allowed me to borrow two biostatistics books that address certain aspects of epidemiology. These books are:

- Glantz, S.A. (2002). Primer of Biostatistics (5^{th} ed). New York: McGraw Hill.
- Glover, T. & Mitchell, K. (2002). An Introduction to Biostatistics. Boston: McGraw Hill.

Closing: I thanked Prof. Ryder for her time and valuable help. She said she was happy to assist, and that the group should feel free to talk to her about any questions we may have in the future.

A.3 CMB STAFF INTERVIEW PROTOCOL

Prior to interviewing the staff of the Capital Management Branch, we developed a set of guiding questions that we would use to start from. The persons interviewed in Appendices A.4 – A.9 were done so by using the following questions as a starting point.

- What do you know about the general background of the site and the motivations for its improvement or relocation?
    - Management of nosocomial infection rates?
    - Length of patient stay?
    - Usage of medications (especially analgesics)?

- What types of renovations are being done to the facility?

- Does the change involve renovation of an existing facility or an actual move to a new facility?

- What critical issues of facility redesign do you feel will most affect patient and staff satisfaction?
    - Who can we contact to arrange focus groups or interviews with appropriate staff members/patients?
    - Could you, if possible, elaborate upon the facility's staff profile?

- Are you aware of a general timeframe for the redesign projects?
    - Will the timeframe be conducive to baseline and follow-up data collection at twelve months?
    - If the renovations are completed before twelve months after baseline collection, how can we be assured that the effects of the new facility will be long lasting?
    - Will there be any detrimental effects on the patients during the construction period?

- Being familiar with the facility operations, what do you feel would be the most effective means by which to compare the pre- and post-renovation data?
    - What data will be available for our use?
        - Medical records, patient/staff surveying availability, data sent to DHS by hospital, billing information?
    - What hospital or administrative personnel can we contact to ensure the willingness of the hospital to participate in the evaluations?

A.4 JIM BARTLETT, DESIGN MANAGER

Date: 16/3/05, 1:00PM
Location: CMB Conference Room #1
Interviewer(s): L. Baldassari, M. Caputo, M. Conforte, C. Werner

Credentials: Design manager of CMB, retired architect, author of recently published design guidelines for hospital construction

Introduction: We became acquainted with Jim upon our entry into the office yesterday, so no further introductions were necessary. Jim is a very friendly, helpful, and knowledgeable individual who was more than happy to assist us in our project.

Q: *Can you tell us some information about the facilities that are going to be renovation and the motivation behind each project?*

A: The Royal Melbourne Hospital was originally built as an American field hospital during WWII, and then was handed over to Australia shortly after the war. This is the oldest hospital in the study, as the building and wards are approximately 70 years old. As a result, the hospital is constrained in terms of services and providing a ward environment suitable for optimised patient recovery. They are in need of more efficient and serviced wards, and have already built a few new wards recently. The major points of this project are increasing space, increasing the number of single-bed rooms, increasing patient amenities, and raising community standards. Another focus of the project is to decrease the distances patients and staff move by increasing the proximity of certain services and areas.

- The Mercy Hospital for Women is run by the Catholic Church, and is therefore non-profit and autonomous. It is housed in an old building in East Melbourne, an area that does not have a high demand for its maternity and neonatal care. It is moving to reach the demand presented by the northeast suburbs of Melbourne into the same building as the newly renovated Austin hospital. This is motivated by a service provision, as the buildings date back to the 1970s, and a need to maximise efficiency of the facility.
- The Austin Hospital was built in the 1980s based on what was thought to be an ideal model for hospital operation and efficiency. However, this mode of operation was found to be completely inefficient. The need was presented for a more flexible building, which is under construction presently and is nearing completion.

- The Dandenong Hospital contains an old ward layout dating back to the 1960s. It is in need of a patient amenity upgrade, which began with the construction of one building, and a second is under construction. The hospital has recently begun to upgrade its technology, and has been met with great success. It is known for its efficient communication system with the use of wireless technology for both telephones and computers.

Q: *What are the major issues, in your opinion, that affect patient and staff satisfaction?*

A: An underlying issue of Australian healthcare is the push to decrease length of patient stay and therefore work more efficiently. Despite these good intentions, patients feel as if they are not receiving proper care or staying in the hospital for an appropriate amount of time for their recoveries.

- The key drive for these renovations is to provide better service by increasing staff efficiency.
- Victoria has employed the WIES system as a complex means by which to calculate the appropriate length of patient stay for their illness profile. This system is used statewide method of determining funding based on data collected from hospitals.
- To most effectively use this funding, hospitals desire to construct or renovate buildings that will increase efficiency of the hospital and therefore allocate more funding by the state.
- Design issues must be taken into consideration when discussing patient and staff satisfaction as well. The concept of a "healing environment" is very popular in Australia, in which the physical setting of the hospital greatly affects patient recovery.

Q: *In regards to the guidelines of hospital design you recently wrote, how do they compare to those published in the United Kingdom by the National Health Service (NHS)?*

A: The DHS guidelines are more based on hospital efficiency than the NHS guidelines. They can be used as a "safety net" to provide a minimum standard for profit-driven private hospitals, and a preventative measure against non-profit public hospitals willing to go above and beyond the recommended standards.

- The guidelines are meant to control the standard of patient amenity in terms of number and location.
- However, these guidelines do not address aesthetics or aspects of the visual environment of a hospital.

Q: *What particular topics in your guidelines do you feel would be of interest to our project?*

A: It is important that we become familiar with Part A of the guidelines, which instructs us on how to use the guidelines. A major subject area for us would be section 340, entitled "Inpatient accommodation unit," which lists recommendations for the construction and space allocations of inpatient wards.

Q: *What do you feel would be the most effective means by which we investigate specific hospital features?*

A: This is an unprecedented project, and the most feasible way to go about doing this would be to work with people in the CMB to better identify both a focus and process for accomplishing this.

- Asking hospital staff for their opinions on this might be counterproductive, as we will most likely acquire four different answers from the facilities.
- Talking to CMB staff will be most helpful because it will allow us to ensure ease of methodology implementation in the hospital. Perhaps a method by which to make this project easier for the hospital staff would be that of an electronic questionnaire.

Q: *How are your guidelines organised and what do you feel is the best way to go about using them? For example, are there any sections dealing with factors affecting a specific outcome measure such as nosocomial infection?*

A: There is a specific section on infection prevention, which we may find very helpful. For example, there is a section on floor finish selection, which lists implications and associated hazards of each floor choice, but does not list standards for each type of ward (but with a few exceptions).

Q: *How did these guidelines influence the development of each of the renovation projects under investigation?*

A: The Austin and Mercy hospitals were not influenced by these guidelines, as they are already built. However, since the guidelines have existed in draft form for a while, they may have been used as a point of reference.

- The Royal Melbourne hospital, due to the fact that construction has not begun, will most likely use the guidelines as a basis for its reconstruction.

- The Dandenong Hospital renovation project most likely used the guidelines in an earlier draft form.

Q: *How will the timeline of the project data collection synchronise with the hospital construction process?*

A: The Austin Hospital project will be okay for the study, as they have yet to move and we are able to collect baseline data on its existing state.

- The Mercy Hospital is due to quickly move next month (April) approximately 15 km away to the AR/M facility. The move may be traumatic and time-consuming, so data collecting from this facility may not be usable or sound for the study. This facility may have to be excluded from the study.
- The Royal Melbourne Hospital will fit into the timeline of the study.
- The Dandenong Hospital may be more complicated, as old wards are still operating as construction proceeds. New wards have been built, but people are still in old wards.

Q: *When we go on-site to visit these hospitals, how will we obtain key contacts within the hospital?*

A: Judith Hemsworth will be a key reference person on this topic. The Metropolitan Health Division on Level 10 of this building (589 Collins St., Melbourne, VIC) should be contacted to designate key people in each hospital for contact with the group.

Q: *What is the extent of information that will be available to us in terms of patient data?*

A: Some desired data may be available via a standardised reporting system operated by the DHS. No medical records will be available, but the overall performance of each hospital in terms of efficiency will be. This data will not be detailed to the individual patient, and it will not contain any identifying information. Parameters included in this system are age group, ethnicity, disease, and outcomes; these are broken down to each hospital. He referred us to Randal Garnham for further explanation of this topic.

Q: *Can you explain to us the healthcare system of Australia?*

A: The old system of Australian healthcare was one in which public hospitals were only for the needy, and staffing was provided on a solely volunteer basis. The public hospitals became dependent on the philanthropy of physicians, and the system became very political. Another option for the Australians in the old system was private healthcare, which the people could pay for to insure.

Twenty-five years ago, the national government of Australia developed a new system called Medicare. This new system took approximately one percent of extra taxes to fund. It operates in such a way that doctors working in public hospitals are paid, but there is no choice of doctor on the part of the patient. In a public hospital, patients may wait longer to be seen unless they are very ill. If the patients would like a choice of doctor, they must pay for private insurance.

Q: *In terms of an income bracket, what class or classes of Australians pay for private insurance?*

A: Usually, any class at or above the middle class can afford to pay for private insurance. Approximately $50,000-60,000 AUD is spent on private health insurance per year, and this amounts to about $1000 AUD per year per family.

Lately, there has been a trend away from private insurance, the percentage of Australians paying for it dropping from 50% to 30%. The trend towards Medicare is quite evident lately, and the government has responded to this by creating tax incentives to shift the focus back to private healthcare. This has begun to work, as the number is back up to 37%, but it is not near the original 50% of Australians under private insurance.

The choice of private or public healthcare depends on the ideology of a person. The shift to public healthcare has been evident lately because private is very expensive in response to a rise in premiums and the lack of government tax incentives.

Q: *Overall, how are the hospital and physician services provided to the Australian people?*

A: The hospitals, both private and public, are very good.

Q: *Outside of hospitals, how do Australians see doctors for services such as yearly physicals and specialist services?*

A: General Practitioners (GPs) operate their own offices, usually in groups of three or four. They are usually private, but they can go under Medicare to attract more patients. If a practice is under Medicare, a patient can be see at no cost to the patient, as Medicare pays for the services. However, there has been an implementation of gap charges, which the patients have to pay out-of-pocket to be seen by a private GP. These gap charges have been a source of great debate among Australians.

Closing: We thanked Mr. Bartlett for his time, and he indicated that he was glad to help with our project.

A.5 RANDAL GARNHAM, MANAGER

Date: 16/3/05, 4:00PM
Location: CMB Conference Room #3
Interviewer(s): L. Baldassari, M. Caputo, M. Conforte, C. Werner

Credentials: Manager of Strategic Asset Planning & Specialist Services

Introduction: Randal was present at our first meeting with our liaison and advisors, so no formal introductions were necessary. He was already familiar with the scope of our project and willing to give his input.

Q: *Can you give us a general background of the sites and their motivations for renovating?*

> ***A:*** Well I had an afterthought that Monash Medical Centre is going to go through a redevelopment in their emergency department as well. So that might be an additional site to look at that would coincide with your timeframe. I spoke yesterday to John Morrissey who is in charge of Capital Redevelopment for Southern Health because Dandenong fits under them as does Monash Medical Centre and he said he would be quite happy to help you.

Q: *How should we go about making other contacts in these outside locations?*

> ***A:*** It might be useful to get your head around what is new and old. Pop into someplace like Dandenong where someone can show you an old ward and a more modern ward just to give you a feel for some of the things that change. If you know what sort of things will change, it might raise some issues.

Q: *What types of data will be available to us and in what form?*

> ***A:*** There are probably two options. One would be information from the agency and the other is what information we collect centrally and that would have to come from operations. I'm not sure whether Judith has had any discussions with operations. Some of that information can be fairly confidential. I think you need to decide what areas of information you are after, then sit down and say how can we get this and is it something that can be made available.

Q: *How would you recommend gathering data about length of stay or medication usage?*

A: Length of stay shouldn't be too hard to find because that is one of the things we use as a performance indicator for agencies, so it is the sort of thing that they collect regularly. I'm not sure what sort of information the hospitals keep on medication. It wouldn't be an issue in an emergency department, but in a ward where a medical patient will undergo surgery they take many different antibiotics for different purposes.

Q: *In our background research we looked at levels of request-contingent medication in single and double bedrooms. Should we look at this?*

A: There is an argument in the rehabilitation end of the game that there are advantages to a multi-bed room. The reason for that is if I'm in heavy rehab and I spend a lot of time in bed, it's great to have someone to chat to. If I was in a single room I would be pretty bored with what was on TV. But if you're in there short stay, acute hospital scenario, we try to throw them out the door as soon as they can walk. You're basically trying to get people through the door and stabilised in lower treatment of care in a lower cost environment. In that situation having single-bed rooms would be advantageous. So it's really a matter of purposes. It would be interesting to ask the nursing staff. I suspect that is the only spot you would get the answer on whether they keep records or not and whether you could access them. But if that is one of the areas you are interested in, make sure they know you aren't interested in what each patient has had but rather whether a patient in a single bedroom has had more than a patient in a four bed ward. They might actually add the medication usage up, unless someone has done a specific study on this.

Q: *Is there a specific area which Australian healthcare facilities are trying to improve upon?*

A: Austin is an interesting case because it is a tertiary hospital, so it is going to be state of the art. It will be up to standard guidelines and there will be more single rooms. If you go at the right time you will be able to look at a current ward and a renovated ward.

Q: *Specifically about Austin, other than a larger proportion of single-bed rooms, what changes are being made?*

A: I actually have some plans on a CD so you can see what it's going to look like. Basically they are going to be reconfiguring a lot of their wards, the wards were typically smaller in the old hospital around 20 to 24 beds, in the new model there are around 32 beds and they have a couple of wards that are linked together with support services alongside. There will also be more isolation rooms and a lot less four bed rooms. Isolation has been driven by a couple of things, one is just managing infections that happen in hospitals and the other is infection control. Air conditioning standards will probably be higher, the physical environment will be better for patients, and it's a well designed building from an energy point of view. You will also see quite significant differences in the emergency department, it will look dramatically different.

Q: *What about colours and artwork?*

A: Hopefully our architects have it well designed. Interestingly, when the Austin set up their colour schemes and feel went for a relatively clinical approach. When you look at the new Austin and Mercy buildings side by side, same architect, Mercy has a much warmer feel to it and that was deliberate. They wanted to have carpet in some areas in wards when Austin had actually gone for a vinyl approach and warmer colours instead of white. It's interesting how the architects have managed to deliver these subtle differences with little cost.

Q: *Are the designs of these hospitals in accordance with the newly developed Design Guidelines or a draft of them?*

A: They will be in accordance with the guidelines in existence at the time, but there were a couple of things where the consultant incorporated a couple of things because the Australian standards were changing in one or two areas. So technically you could have gotten away without putting some of the current switches in areas that we actually built into the design. We took a strictly legal minimum cost approach, we could have actually got away without it and the reason is we knew it was going to happen. So for the extra few dollars we figured we would do it right now.

Q: *What is the sustainability of these projects? How long before things will need to be renovated or replaced?*

A: We would expect the basic structure to stand up for 50 years. It was built so it you want to reconfigure an area in a few years time you can do it relatively easily. We went through a period in Australia where people were building solid brick walls because they were cheap to construct but it made remodelling difficult because the brick walls were needed for support. With the Austin there are large spans with minimal column sises, so it's quite flexible in terms of structure. We should get 20 to 25 years out of a ward before we need to start doing any refurbishment. The need to refurbish is not so much driven by the fact that it's falling apart but by the way we deliver services changing. In an imaging area where technology is changing rapidly, you might need to redevelop it in ten or 15 years.

Q: *Who makes the decision for a site to be redeveloped?*

A: The agencies develop proposals. So if at Dandenong hospital I have an emergency department that is bulging at the seams and its not working for functional issues, then I would say to DHS we need to do a redevelopment here. So they get onto our priority list of projects and we have a couple of levels of priority. The ones we look at and say, yes they are in very poor condition or they are on emergency bypass because they are always overloaded, that would be a red flag that we really need to redevelop a facility. We have a metropolitan health strategy which is an overall service framework. So ideally, whatever an agency proposes should fit together with that strategy and that's mapping out where we see services going in the future. Then each of the health services should develop a service response to that and that translates into a service plan for each facility.

Q: *Is an agency an individual facility?*

A: In the metropolitan area we have health services, like Southern Health which picks up areas like Dandenong hospital, Monash Medical Centre, Barrack, so one health service is in charge of more than one facility. In days gone by, Monash Medical Centre was an agency then a bunch of agencies were merged together as health service.

Q: *How are hospitals grouped into agencies? Do they offer similar areas of care or are they in the same area?*

A: Monash is a Level 6 teaching hospital, the highest end of the spectrum, so they can provide quite complex services but within that same health service is Dandenong which has more of a community flavour to it, nevertheless it has some teaching also. So there is a bit of variation. One of the reasons of forming a health service is to stop some of the competition and bring their specialties together.

Q: *How many hospitals are there in the city?*

A: There are around 20 around the metro area.

Q: *When a project is completed is there a procedure that DHS follows to evaluate it?*

A: We have got a draft Post Occupancy Evaluation (POE) guidelines which we have used in the past. POE can mean different things to different people, if I'm an architect I'm interested in fabric and walls and I would have a very detailed focus. Someone else might come in with a completely different set of eyes and say what was the service model they intended and has it worked. So you have to be careful when using the term POE. They can all be valid, but provide different information.

Closing: We thanked Randal for his time, and he indicated that we could ask him more questions in the future as needed.

A.6 JOHN KINSMAN, PRINCIPAL ARCHITECT

Date: 3/17/05, 2:00PM
Location: CMB Conference Room #1
Interviewer(s): L. Baldassari, M. Caputo, M. Conforte, C. Werner

Credentials: Principal Architect of Strategic Asset Planning & Specialist Services

Q: *What exactly is your role as Principal Architect of the CMB?*

A: He responded by saying that he was not very involved in public hospitals, but was responsible for approving guidelines that allow a health facility to become registered. He also noted that public and denominational hospitals were exempt from this registration process because they are either partially or totally developed by the government.

Q: *Please describe this hospital approval/registration process.*

A: He explained to us that two years ago, private hospital programs were three times the number of public programs. John elaborated by describing Strategic Asset Planning Projects (SAPs), which are infrastructure projects used to plan the development of hospitals. Staff members of these projects report to and/or assist the Project Managers, who work within the CMB. Budget benchmarking is used to get a proper basis of the project. He emphasised that these Project Managers and associated staff do not design the hospitals, but are responsible for employing consultants to do so.

Q: *Have any trends in healthcare been apparent lately in terms of design influence?*

A: He explained four major trends to us:

- Infection control – The Department is focused on design that will decrease the incidence of nosocomial infection. For example, no cavity sliders are permitted in hospitals.
- Isolation rooms – The presence of these rooms for the increase of infection control warrant a separate set of guidelines from DHS.
- Workplace health and safety – A primary concern of DHS is to keep the healthcare staff members satisfied and safe in their workplace. Such a

concern is meant to increase hospital performance by resulting in optimum staff performance.

- Liability – This trend has arisen as a corollary to the previous (workplace health and safety), and focuses more on patient care and malpractice. A difficulty in this issue has been with staff compliance of newly implemented precautions/standards.

Also in place is the Building Control Act (BCA), which established building codes and regulations on a national level. These are statutory obligations, which require a building permit following inspection by independent building surveyors. DHS inspects the private hospitals in order to register them with a certificate of compliance of building code. However, this BCA has no influence on design because they are minimum standards.

- The BCA serves as a maximum for public hospitals (as they are not profit driven), and a minimum for private hospitals (which are profit driven and would want to save money in hospital development.
- The Chief Electrical Inspector's Office is responsible for the statutory compliance of Victorian hospitals in terms of electricity guidelines.
- These guidelines are used in terms of benchmarking for hospitals as larger corporations.
- Private and public guidelines are put together in order to create what is thought to be the most efficient and cost-effective healthcare facility.

Other major motivations behind hospital renovation projects include:

- Room size
- Workplace safety
- Statutory guidelines
- Infection control
- Communication efficiency/reliability

However, guidelines in place do not address technology standards. Infrastructure problems that have arisen for public hospitals include spending capital investment to keep them going; and for private hospitals includes the fact that DHS is not involved in the maintenance of the facility, but is responsible for the healthcare provided. The latter situation often warrants a conflict of interest between DHS and private hospital corporations.

Q: *How does benchmarking influence the hospital development process?*

A: Benchmarking influences public hospital development only, and Judith Hemsworth is the driver behind this influence. He advised us to talk to Judith and look at the guidelines established by the CMB for hospital building and quality control.

Also in place is a FABRIC survey, which lays out a service plan for hospital redevelopment. It incorporates benchmarking with the number of beds and guidelines of up to date costs. This gives cost for generic features, but is not a strict set of guidelines because it provides many different ways to carry out a project, not minimum standards in terms of quality.

Q: *Does staff safety in the workplace affect these guidelines?*

A: In place is a "No Lift Policy," which states that staff members are not allowed to move patients over 20kg. Therefore, the guidelines are in place to prevent the usage of carpets, which may inhibit the flow of trolleys; but at the same time, carpeting eliminates the possibility of patients falling on vinyl floors.

Also in these guidelines are the potential effects, processes, and area allocations associated with each design decision and consideration. Guidelines associated with mobile equipment usage come from empirical evidence, as does guidelines associated with basins, central sterilizing units, allocation of different diagnostic spaces, and making hospitals more space-efficient.

Q: *What are major considerations taken in hospital design?*

A: "Form follows function" is a major driving factor in hospital design. An idea taken into consideration for design projects is to not make the hospital look like a hospital. However, John disagrees with this and feels that hospitals should be "practical, not grandiose."

Q: *What other processes are involved in hospital redesign?*

A: Also in place is a Briefing Setup, which is very important to obtain the correct scope and setup a fence around the project. Sustainability of design is also taken into consideration during these Briefing Setups.

Q: *Is there anything else that hospital designers must taken into account about project feasibility and execution?*

A: Hospital architects must have both “flair and knowledge” in the field, and also need to make sure that the existing hospital can operate while under construction. This is difficult to benchmark, but the appropriate consultants are hired to ensure project completion in the most effective way possible.

Closing: We thanked Mr. Kinsman for his time, and he said that he was happy to help.

A.7 ALLAN STOKES, PROJECT MANAGER

Date: 18/3/05, 10:00AM
Location: CMB Conference Room #1
Interviewer(s): L. Baldassari, M. Caputo, M. Conforte, C. Werner

Credentials: Manager of Metropolitan Projects: individual responsible for the planning, design, and (indirectly) construction of metropolitan health projects; there exist six project managers (managing individual projects at different locations) working under him. Allan provides senior management and oversight, assuming a management-type role; has overall responsibility.

Introduction: Explained the premise of our project: examine the built healthcare environment in terms of patient/staff satisfaction, instance(s) of nosocomial infection, length of stay, and medication levels. Additional Goal – develop the means for assessing these factors.

Q: *What are the motivations for hospital reconstruction or renovation?*

> ***A:*** There are a large number of ambulance bypasses; need to shorten ER stays; overloaded ER departments –not uncommon for someone to enter the ER and have to wait an unacceptable amount of time for care (reduction of waiting periods); need to replace substandard ward accommodations; and, need to increase efficiency (resulting in a reduction of operating costs).

Q: *What can you tell us about the Royal Melbourne Hospital?*

> ***A:*** Allan was the on-site project manager for eight yrs.
>
> - Refurbish (significant tertiary) hospital in stages.
> - A shifting of wards to new hospital building:
>   - need for state-of-the-art diagnostic and medical equipment
>   - existing accommodations were a hindrance to services delivery
>   - efficiency = lower costs
> - Changes:
>   - Combination of both *refurbishing* of existing/outdated space and *relocation* of day procedures facilities – efforts done to decrease length of stay (outpatient).

    - New Alfred Centre (the Alfred Hospital) – a new area for day elective surgery procedures– attempt to reduce the average length of stay to three days.
    - Efforts to modernise the service infrastructure to maintain the built environment.
        - underground service tunnel
        - entirely new building with a helipad
    - Set new standards of accommodation.
        - three new 60-bed wards
        - an addition to the Royal Women's Hospital (decision made during existing construction)
        - changes in colour schemes, overall ambience, layout, furniture, etc.
- Despite the fact that the RMH is the 2nd-largest current DHS project, significant strides have been taken to minimise the impact of work on the hospital.
- The existing buildings' standards are, at the moment, good. The project attempts to refit this existing basic structure for the purposes of upgrading levels of service delivery.

Q: *Could you give us some suggestions of persons to talk to within the hospital?*

A: Speak to both architects and the actual health agencies themselves, for extensive advice on the subject. Some architects have begun to do research on the following topics:

- improvement of the physical environment – as a result, patient and staff satisfaction will increase
- increase in quality of life (e.g. – if appetite improves, patient requires less medication)
- decrease in average length of stay

Q: *What are some other factors that we may want to consider when developing our plan to assess the built environment?*

A: Staffing

- Substandard facilities yield reductions in staff productivity.

- Designers need to take into consideration:
  - the physical layout
  - hospital design affects the way that individuals approach their job.
- Definite need to question clinical individuals in this respect.

Environmental Evaluation Measures

- Post-Occupancy Evaluations – Judith Hemsworth.
  - conducted for twelve facilities – addressed a range of factors (not just patient/staff satisfaction or patient outcomes).
  - contains references to evaluation measures.
- POE guideline document details how to carry out a POE evaluation.

Environmental

- Recent push towards ESD – Ecologically Sustainable Design.
- Emphasis on efficiency, for example:
  - H_2O consumption
  - air quality
- Effects the following areas:
  - fresh air (open windows)
  - mechanical ventilation (AC settings)

Infection control raises obstacles; these obstacles, in turn, necessitate a benchmarking process, which leads to the development of cost analysis tools.

Conditions Surveys – a component of the asset management program, which is headed by Randal Garnham. These surveys assess the relative physical state of a facility in order to identify those with the greatest need for refurbishment/renovation. Also allow for staff assessment of various built environment elements – air quality, light, utilisation of space, views, etc.

Bi-products of Interview: Allan will talk to RMH contact individual, who may be able to set the group up with patients/staff to interview.

Closing: We thanked Mr. Stokes for his time, and he said that he was happy to help.

A.8 ROBIN CHONG, PROJECT MANAGER

Date: 18/3/05, 11:00AM
Location: CMB Conference Room #2
Interviewer(s): L. Baldassari, M. Caputo, M. Conforte, C. Werner

Credentials: Expert on design changes to the built environment, with particular attention paid to air delivery function and lighting.

Introduction: Explained the background of the project to Robin, who had been previously introduced to our project via Judith Hemsworth's presentation to various CMB staff members. Offered some of the specific areas of concern of the project – nosocomial infection, medication levels, length of patient stay, and overall patient satisfaction. We informed Robin of the four facilities being considered for potential group investigation – Royal Melbourne Hospital, Dandenong, the Austin, and the Mercy Hospital for Women.

Q: *Explained to Robin that the group is currently at the stage of information gathering, attempting to find contacts within the facilities themselves. We asked if he had any recommendations of people to talk to.*

A: Robin suggested that we should talk to services engineers and involved architects (from various firms).

Q: *We understand that design guidelines are helpful in understanding the changes made to different areas of the hospital. Since the document is a rather lengthy few-hundred pages long, what sections would you recommend that we look at?*

A: The guide is organised by different areas and the type of level of care which they administer. Robin thought that we should look at the section on air quality and lighting. A thorough examination of the guidelines will be necessary for specifics to be located.

Q: *What types of things do you think we should be looking at in patient rooms in the individual wards?*

A: Lighting within rooms, air:

- Outside air (smells, bacteria or infection, etc.).
- Air conditioning (percentage of outside air and percentage of return air).

Robin also noted some things to note for emergency rooms with regards to ventilation and air quality:

- The main difference is higher standards of air quality.
- Higher amount of air changes (eight to ten in a ward vs. 20 or more in an emergency room or operating theatre).
- Higher exchange rate of air, with 100% outside air, 15 changes…with 50% outside air, 20+ changes.
- Cooling – air passing through a panel of water…need 38 changes to keep air clean to standards. 20 is a lot, 38 is an enormous amount.

Q: *Could you give us more information about lighting?*

A: There exist minimum lux levels which must be maintained for different criteria, this may be something you want to measure. Lighting levels are set by both necessity and cost (energy consumption). The Department used to have a light meter, or lux meter; this is something you could look into.

Q: *What about temperature?*

A: Elderly persons preferred radiated heat from a source, whereas staff and other persons preferred air heated at another location and vented throughout the facility; staff thought this kind of heating was uncomfortable. This brings up the argument – giving the patients what they want/need vs. giving the staff members what they want/need.

Also, indirect changes to benefit the staff. For example, the need for heightened air exchange rate is affected by the number of staff working and the areas that they move in and out of.

Another item to look at is how and where air is exhausted. You should look at where the air moves to, through what portions of the hospital it travels.

Q: *Do you know anything about the food services within hospitals?*

A: Originally, hospitals (most of them) had their own kitchens and did their own cooking. However, there has been a recent trend towards centrally located preparation and cook facilities. Food is cooked at a central location, then chilled

(blasted with freezing temperatures very quickly), and then shipped off to the various outlying locations, where they are then reheated and served.
Status of kitchens at hospitals the group is considering:

- Royal Melbourne Hospital – may have its own kitchen.
- Others – remain unknown.

Q: *What types of contact would we be able to have with people within the hospitals?*

A: Robin could not give us details about other hospitals but told us about Mercy Hospital. Contact within Mercy Hospital could be arranged by Robin, possibly with engineers and/or architects. An ideal person to contact would be an individual involved in the registering of patient complaints.

Robin suggested that we set up some sort of general schedule so that this on-site meeting can be planned. Such a meeting will be determined by the group's ability to focus and limit areas of interest.

A few general recommendations that came up during this rather informal interview are listed below:

- Determine the specifics of what is to be examined…

- Best case for collecting data…the Austin and the Mercy, move is relatively soon.

- Speak with Siva concerning Dandenong

- Old vs. New ward examination.

- Questionnaire: How are you going to measure the components or factors that you deem important?
  + Based on opinion of persons…all people are different.
  + Different metabolic rates, some like colder or hotter…complicates things.

***This leads to patient control over the environment, e.g. – patient's ability to control the temperature in their room, or their ability to control the amount of fresh air they receive.

****This, in turn, leads to a discussion of degree of patient control vs. infection risks/rates.

Closing: We thanked Mr. Chong for his time, and he said that he was happy to help.

A.9 SIVA SIVATHASAN, PROJECT MANAGER

Date: 21/3/05, 2:00PM
Location: CMB Conference Room #1
Interviewer(s): L. Baldassari, M. Caputo, M. Conforte, C. Werner

Credentials: Project Manager for Dandenong Hospital

Introduction: We had been introduced to Siva when we began working at the CMB office, so no formal introductions were necessary. Siva is the Project Manager for Dandenong Hospital, making him a valuable resource for collecting site-specific information.

Q: *What kinds of renovations will be taking place at Dandenong Hospital?*

> ***A:*** The stage one will be completed 18 to 24 months before is about $25 million in cost. What it did was give us a new ward with four levels and roughly 100 to 120 beds. Some of the existing stock which was old and slightly outdates were relocated here. So I don't know if you'd call it renovations, it was basically replacing old stock and in the process they added very few additional beds. So whether that fits into your renovation terminology or not I'm not sure, but what they have got is new hospital facilities. Some of the old stock have been closed or they are being used for something else and the patients are being treated from the new ward.
>
> There is a stage two currently being built that is $34 million total in cost, but that is just in construction now. So I think for your study that may not be of any use to you. The earliest it would be completed is March '06. If you go to visit you will see all bricks and concrete.

Q: *Can you explain the patient amenity upgrade that will occur at Dandenong?*

> ***A:*** I don't go into what amenities will be changed but what I can tell you is that the facility we will be providing will be much more superior than the what they are occupying now and all of these facilities' level of accruement and communication facilities and nurse calls.

Q: *What are the reasons for the renovations at Dandenong?*

A: Primarily its because the existing building stock is old so that needs to be upgraded and the medical technology is always changing so some of the old bays have passed there due date. Growth is another reason but you have to remember that the stage one and two they will have some additional beds but we are not talking expansion mostly replacement.

Q: *How do you anticipate these changes affecting patient and staff satisfaction?*

A: It is difficult to ask the project manager because they are probably going to second guess here because what we don't get involved in is how patients are going to see this but we know that at user group meetings clinical staff and administrative staff come together to discuss this. So I have seen and I have heard clinical staff saying many times that the facilities that are provided or the services available are not the level they need and the other hospitals have more updated facilities. So they think these patients are going to feel better. I think the main thing is communication. There has been a push to call support more efficiently and also the way they design the hospital is so that the support and assistance can come very quickly.

Q: *Have they discussed other methods of increasing the hospital efficiency?*

A: They do. We from the CMB do not attend all of the user group meetings, we might not attend any meetings at all because we have project managers and architects working for us but we often see some of the activity in the minutes. I think every detail whether it is going to be ward or bed or access are all discussed at these meetings. Some of the people whom you'll be meeting will have attending these meetings.

Q: *How does this project compare to the Royal Melbourne Hospital project in terms of size and scope?*

A: The Royal Melbourne had about three or four phases in it. We are talking about $80 to $95 million, but Dandenong could run $55-60 million. Royal Melbourne will be about 30-40% bigger in terms of money. At Royal Melbourne things will be expanding up whereas we are going sideways because Royal Melbourne has to fit in the CBD. Dandenong has more land so they can go sideways.

Q: *What kinds of wards will be in stage two?*

A: Intensive Care Units and Coronary Care Units comprise more of the wards. Stage one has one level sub-acute and the remainder was surgical/medical.

Q: *What do you mean by the term sub-acute?*

A: When people are out of the acute units and not ready for a nursing home, rather then punishing the area that is highly sophisticated you bring them into a middle area where they can stay longer and get better.

Q: *Would there be more views of nature at the Dandenong Hospital that the Austin Hospital because it is outside of the CBD?*

A: Austin is not in the CBD, it is on the other side. In theory there should be more views here than the Royal Melbourne but when you go to visit you will see that is all surrounded by buildings because Dandenong is the second biggest city next to Melbourne. You tend to be more relaxed there than in the city.

Q: *Are you aware of any wide-spread nosocomial infection motivating renovations?*

A: I don't think so. The clinical people can tell you more but I know this project was not prompted by infection issues.

Q: *If Dandenong is not as concerned with conservation of space do they consider the same design guidelines when designing the wards?*

A: As far as the wards are concerned, we still follow the guidelines. Having said that space is a bit more flexible, doesn't mean there isn't any constraints. We are trying to buy additional land if we can. All schematics and master designs come back here to be signed off, so if they are not following the guidelines or they don't explain the variation they will not be signed out.

Q: *How flexible are variations from the guidelines?*

A: Guidelines are a standard document. We try to be less flexible but understanding and only make exceptions when there is a genuine need. We go by exceptions.

Q: *How old is the Dandenong Hospital?*

> ***A:*** It was originally a community hospital so some of the buildings, not all of them, can be about 78 years old. However, they may not be the ones which we are replacing. Each building has a different age. People at the hospital will give you more information about that.

Q: *Do you have any suggestions for finding information on medication usage or length of stay?*

> ***A:*** Medicine usage, only the hospital can help you, but length of stay, people in the program area metropolitan health and age care may be able to help you because they look at the program end of it.

Closing: We thanked Siva for his time and he offered to help find additional information or contacts at Dandenong Hospital.

Appendix B: Assessment Tools

B.1 SATISFACTION SURVEYS

B.1.1 Patient Satisfaction Survey

The three individual items of the patient satisfaction survey appear in the following order:

- Patient information sheet
- Patient satisfaction survey
- Major categories for each question of the patient satisfaction survey

(Documents begin on next page).

Patient Information Sheet

This project is looking at patient and staff attitudes and perceptions of the built environment of public hospitals in Victoria.

Whose project is this?

We are a group of engineering students working in conjunction with the Capital Management Branch of the Department of Human Services.

What is the purpose of this survey?

We hope to learn about elements of a hospital that are important to patients and staff and affect their satisfaction with the physical environment (layout, views, colours, cleanliness, lighting, signage, room comfort, etc.).

Why have I been asked to participate?

As a recent patient within this facility, your opinions of its environmental elements are very valuable to us. We would appreciate it if you were willing to spend some time and take part in this survey.

How will the survey be conducted?

The survey takes about 20 minutes to complete; the interviewer will ask you a series of questions. He or she will present each question individually and document your response, allowing you to focus on the survey material and your own perceptions.

Will the information I give be confidential?

Any information about yourself or any other individuals mentioned during the question/answer period will be kept confidential. We do NOT need to know any personal information about you or your treatment.

What happens if I change my mind about participating?

You may inform the interviewer at any time that you no longer wish to take part in the project. A reason is not needed, and your hospital care will not be affected in any way.

What are the benefits of taking part?

While there is no direct benefit to you, the information you provide will help to plan and provide better healthcare facilities in the future.

What happens now?

The interviewer will give you some additional information concerning the administration of the survey and the types of questions you can expect to be asked to answer.

Prepared by: Laura Baldassari, Michael Caputo,
Molly Conforte, Christopher Werner, © 2005

State Government Victoria Department of Human Services

WPI

Hospital Name: _____
Ward ID: _____
Room Number: _____
Date: _____

PATIENT SATISFACTION SURVEY

INSTRUCTIONS FOR SURVEY COMPLETION

ABOUT THE SURVEY

This survey is about your *overall* satisfaction with specific factors of the built environment of the hospital at which you are currently being treated. It asks for ***your opinion*** about building/environmental features which may have affected your most recent stay at the hospital.

- Not everybody experiences all the factors of the built environment that may be listed on this survey. If you feel you do not have adequate experience with any specific factor identified in the questions below, just circle the ***"N/A"*** response.
- Sometimes you may consider a specific environmental factor in one part of the hospital to be excellent and in another part of the hospital to be poor. We want your ***overall*** opinion.
- There are no right or wrong answers; it is ***your opinion*** that is important.
- Your answers are important. They will help the Department of Human Services to plan renovations or new facilities that are more responsive toward the needs of patients and staff. ***REMEMBER, THE SURVEY IS COMPLETELY CONFIDENTIAL.*** No personal information or information related to the reason for your hospital admission will be collected.
- If you are assisting someone to complete this questionnaire, it is important that the ***patient's*** point of views are presented. If you have your own issues, please keep them to yourself and do not persuade the patient.

COMPLETING THE SURVEY

To complete the survey, please follow the instructions by either placing X's in the boxes or circling the numbers as required. An example of how to do this has been provided below.

EXAMPLE ONLY

The person completing the example has chosen "4" as the number of wheels on a standard automobile. In the second question, the person was "Satisfied" with the driver's seat of his or her automobile. However, this person did not have adequate knowledge of their automobile's engine, so selected "N/A" for their satisfaction of this item.

E1. **How many wheels does a standard automobile have?**

⇒ ☐ 2 ☐ 3 ☒ 4 ☐ 7

E2. **How satisfied are you with the following features of your automobile?**
*(Please circle **one** response for each item.)*

	Very Unsatisfied		*Neutral*		*Very Satisfied*	*Can't Say*
2a. Driver's seat	1	2	3	(4)	5	N/A
2b. Engine	1	2	3	4	5	(N/A)

Q1. Please provide some information about yourself and your hospital stay so far:

1a. Which age group do you belong to?

⇒ ☐ Under 20 years ☐ 20-40 years ☐ 41-60 years ☐ Over 60 years

1b. What is your gender?

⇒ ☐ Male ☐ Female

1c. How long have you been at this hospital for this admission?

⇒ ☐ 3 days or less ☐ 4 to 6 days ☐ 7 days or more

1d. How many patients are being cared for in your room (including yourself)?

⇒ ☐ 1 ☐ 2 ☐ 3 ☐ 4

1e. Can you see out of the window from your bed?

⇒ ☐ Yes ☐ No

1f. Do you have an en-suite bathroom?

⇒ ☐ Yes ☐ No

Q2. How satisfied were you with the following elements of your hospital visit? *(Please circle **one** response for each item.)*

		Very Unsatisfied		*Neutral*		*Very Satisfied*	*Can't Say*
2a.	Size of room	1	2	3	4	5	N/A
2b.	Layout of room	1	2	3	4	5	N/A
2c.	Size and ease of use of bathroom facility	1	2	3	4	5	N/A
2d.	Space/security for your belongings in room	1	2	3	4	5	N/A
2e.	Space for visitors in your room	1	2	3	4	5	N/A
2f.	Nurse call system	1	2	3	4	5	N/A
2g.	Number of patients in your room	1	2	3	4	5	N/A
2h.	Amount of personal space	1	2	3	4	5	N/A
2i.	Level of privacy in your room	1	2	3	4	5	N/A
2j.	Level of social interaction	1	2	3	4	5	N/A
2k.	Degree of contact with staff	1	2	3	4	5	N/A
2l.	Presence of artwork	1	2	3	4	5	N/A
2m.	Colour scheme of the hospital interior	1	2	3	4	5	N/A
2n.	Physical condition of room	1	2	3	4	5	N/A
2o.	Overall tidiness of the hospital environment	1	2	3	4	5	N/A
2p.	Ability to see out of your window	1	2	3	4	5	N/A
2q.	Quality of view from your window	1	2	3	4	5	N/A

Q3. **How satisfied were you with the following elements of your hospital visit?** *(Please circle **one** response for each item.)*

		Very Unsatisfied		*Neutral*		*Very Satisfied*	*Can't Say*
3a.	Amount of natural light through your window	1	2	3	4	5	N/A
3b.	Control over natural light (sunlight)	1	2	3	4	5	N/A
3c.	Lighting of corridors	1	2	3	4	5	N/A
3d.	Lighting of your room	1	2	3	4	5	N/A
3e.	Ability to control different types of lighting in room	1	2	3	4	5	N/A
3f.	Lighting of en-suite toilet/bathroom *(if applicable)*	1	2	3	4	5	N/A
3g.	Freshness of air in your room	1	2	3	4	5	N/A
3h.	Existence of odours in your room	1	2	3	4	5	N/A
3i.	Air temperature in your room	1	2	3	4	5	N/A
3j.	Control over temperature	1	2	3	4	5	N/A
3k.	Control over natural ventilation (fresh air)	1	2	3	4	5	N/A
3l.	Daytime noise level	1	2	3	4	5	N/A
3m.	Night-time noise level	1	2	3	4	5	N/A
3n.	Ability to rest or sleep in your room	1	2	3	4	5	N/A
3o.	Safety and comfort of flooring	1	2	3	4	5	N/A
3p.	Lighting glare produced by hospital surfaces	1	2	3	4	5	N/A
3q.	Presence of signs to help you find your way around	1	2	3	4	5	N/A
3r.	Legibility of signs to help you find your way around	1	2	3	4	5	N/A
3s.	Cleanliness of floors/benchtops	1	2	3	4	5	N/A
3t.	Cleanliness of toilets/bathrooms	1	2	3	4	5	N/A
3u.	Television access	1	2	3	4	5	N/A
3v.	Access to telephone	1	2	3	4	5	N/A
3w.	Entertainment activities	1	2	3	4	5	N/A
3x.	Accessibility to outdoors	1	2	3	4	5	N/A
3y.	Quality of garden/outdoor area	1	2	3	4	5	N/A

Q4. How satisfied would you be with views of the following scenes out your window?
*(Please circle **one** response for each item.)*

		Very Unsatisfied				*Very Satisfied*	*Can't Say*
4a.	Nature (trees, etc.)	1	2	3	4	5	N/A
4b.	Sky	1	2	3	4	5	N/A
4c.	Buildings	1	2	3	4	5	N/A
4d.	Ground	1	2	3	4	5	N/A
4e.	Human activity (people, cars, etc.)	1	2	3	4	5	N/A
4f.	Locational clues (landmarks, main roads, etc.)	1	2	3	4	5	N/A

Q5. Were you disturbed by any of the following noises during your current hospital stay?
*(Please mark **all** that apply.)*

⇒ ☐ Medical Equipment
☐ Other patients/roommates
☐ External noise (traffic, construction, etc.)
☐ Use of bathrooms
☐ Meal delivery
☐ Staff (talking, etc.)
☐ Telephones
☐ Cleaners
☐ Visitors
☐ Other

Thank you for completing this survey! Please check that you have answered all questions.

Again, thank you for your assistance. Your feedback will help the Department of Human Services to better allocate funds for hospital renovation projects and improve the quality of care.

Prepared by: Laura Baldassari, Michael Caputo, Molly Conforte, Christopher Werner,

Patient Satisfaction Surveys – Major Categories

Q1a, 1b, 1c, 1d, 1f: N/A

Q1.

1e.	*Windows*	Can you see out of the window from your bed?

Q2.

2a.	*Room size*	Size of room
2b.	*Room size*	Layout of room
2c.	*Room size*	Size and ease of use of bathroom facility
2d.	*Room size*	Space/security for your belongings in room
2e.	*Room size*	Space for visitors in your room
2f.	*Control*	Nurse call system
2g.	*Room size*	Number of patients in your room
2h.	*Room size*	Amount of personal space
2i.	*Room size*	Level of privacy in your room
2j.	*Positive distractions*	Level of social interaction
2k.	*Positive distracitons*	Degree of contact with staff
2l.	*Aesthetics & Positive distractions*	Presence of artwork
2m.	*Aesthetics*	Colour scheme of the hospital interior
2n.	*Aesthetics*	Physical condition of room
2o.	*Aesthetics*	Overall tidiness of the hospital environment
2p.	*Windows*	Ability to see out of your window
2q.	*Windows*	Quality of view from your window

Q3.

3a.	*Windows*	Amount of natural light through your window
3b.	*Windows & Control*	Control over natural light (sunlight)
3c.	*Lighting*	Lighting of corridors
3d.	*Lighting*	Lighting of your room
3e.	*Lighting & Control*	Ability to control different types of lighting in room
3f.	*Lighting*	Lighting of en-suite toilet/bathroom
3g.	*Ventilation*	Freshness of air in your room
3h.	*Ventilation*	Existence of odours in your room
3i.	*Ventilation*	Air temperature in your room
3j.	*Control & Ventilation*	Control over temperature
3k.	*Control & Ventilation*	Control over natural ventilation (fresh air)
3l.	*Noise*	Daytime noise level
3m.	*Noise*	Night-time noise level
3n.	*Noise*	Ability to rest or sleep in your room
3o.	*Flooring*	Safety and comfort of flooring

3p.	*Flooring*	Lighting glare produced by hospital surfaces
3q.	*Wayfinding*	Presence of signs to help you find your way around
3r.	*Wayfinding*	Legibility of signs to help you find your way around
3s.	*Cleanliness*	Cleanliness of floors/benchtops
3t.	*Cleanliness*	Cleanliness of toilets/bathrooms
3u.	*Positive distractions*	Television access
3v.	*Positive distractions*	Access to telephone
3w.	*Positive distractions*	Entertainment activities
3x.	*Positive distractions*	Accessibility to outdoors
3y.	*Positive distractions*	Quality of garden/outdoor area
Q4.		
4a.	*Positive distractions*	Nature (trees, etc.)
4b.	*Positive distractions*	Sky
4c.	*Positive distractions*	Buildings
4d.	*Positive distractions*	Ground
4e.	*Positive distractions*	Human activity (people, cars, etc.)
4f.	*Positive distractions*	Locational clues (landmarks, main roads, etc.)
Q5.	*Noise*	Disturbed by any of the following noises?

B.1.2 Staff Satisfaction Survey

The three individual items of the patient satisfaction survey appear in the following order:

- Staff information sheet
- Staff satisfaction survey
- Major categories for each question of the staff satisfaction survey

(Documents begin on next page).

Staff Information Sheet

This project is looking at patient and staff attitudes and perceptions of the built environment of public hospitals in Victoria.

Whose project is this?

We are a group of engineering students working in conjunction with the Capital Management Branch of the Department of Human Services.

What is the purpose of this survey?

We hope to learn about elements of a hospital that are important to patients and staff and affect their satisfaction with the physical environment (layout, views, colours, cleanliness, lighting, signage, room comfort, etc.).

Why have I been asked to participate?

As a staff member within this facility, your opinions of its environmental elements are very valuable to us. We would appreciate it if you were willing to spend some time and take part in this survey.

How will the survey be conducted?

The survey takes about 20 minutes to complete; the interviewer will ask you a series of questions. He or she will present each question individually and document your response, allowing you to focus on the survey material and your own perceptions.

Will the information I give be confidential?

Any information about yourself or any other individuals mentioned during the question/answer period will be kept confidential. We do NOT need to know any personal information about yourself.

What happens if I change my mind about participating?

You may inform the interviewer at any time that you no longer wish to take part in the project. A reason is not needed, and your employment will not be affected in any way.

What are the benefits of taking part?

While there is no direct benefit to you, the information you provide will help to plan and provide better healthcare facilities in the future.

What happens now?

The interviewer will give you some additional information concerning the administration of the survey and the types of questions you can expect to be asked to answer.

Prepared by: Laura Baldassari, Michael Caputo,
Molly Conforte, Christopher Werner,

State Government Victoria Department of Human Services

WPI

Hospital Name: _____
Ward ID: _____
Date:

STAFF SATISFACTION SURVEY

INSTRUCTIONS FOR SURVEY COMPLETION

ABOUT THE SURVEY

This survey is about your *overall* satisfaction with specific factors of the built environment of the hospital at which you are currently working. It asks for ***your opinion*** about architectural features which may affect your job duties.

- Not everybody experiences all the factors of the built environment that may be listed on this survey. If you feel you do not have adequate experience with any specific factor identified in the questions below, just circle the ***"N/A"*** response.
- There are no right or wrong answers; it is ***your opinion*** that is important.
- Your answers are important. They will help the Department of Human Services to better develop future hospital renovations toward the needs of patients and staff. ***REMEMBER, THE SURVEY IS COMPLETELY CONFIDENTIAL.*** No information that will identify you will be given to anyone at the hospital.
- If you are assisting someone to complete this questionnaire, it is important that the ***patient's*** point of views are presented. If you have your own issues, please keep them to yourself and do not persuade the patient.

COMPLETING THE SURVEY

To complete the survey, please follow the instructions by either placing X's in the boxes or circling the numbers as required. An example of how to do this has been provided below.

EXAMPLE ONLY

The person completing the example has chosen "4" as the number of wheels on a standard automobile. In the second question, the person was "Satisfied" with the driver's seat of his or her automobile. However, this person did not have adequate knowledge of their automobile's engine, so selected "N/A" for their satisfaction of this item.

E1. **How many wheels does a standard automobile have?**

⇒ ☐ 2 ☐ 3 ☒ 4 ☐ 7

E2. **How satisfied are you with the following features of your automobile?**
*(Please circle **one** response for each item.)*

	Very Unsatisfied		*Neutral*		*Very Satisfied*	*Can't Say*
2a. Driver's seat	1	2	3	(4)	5	N/A
2b. Engine	1	2	3	4	5	(N/A)

Q1. **Who is your employer?**

⇒ ☐ This hospital/network ☐ Nursing agency ☐ Other ☐ Prefer not to say

Q2. **What is your position?**

⇒ ☐ Nursing staff ☐ Administration staff ☐ Other: _____

Q3. **How long have you worked in this ward?**

⇒ ☐ Less than 1 month ☐ 1-6 months ☐ 6-12 months ☐ Over 1 year

Q4. **How satisfied are you with the following features of the built environment *in terms of supporting you to deliver services to patients*?** *(Please circle **one** response for each item.)*

		Very Unsatisfied				*Very Satisfied*	*Can't Say*
4a.	Number of beds in ward	1	2	3	4	5	N/A
4b.	Ratio of single to double to four bed rooms	1	2	3	4	5	N/A
4c.	Layout of ward (ability to monitor patients/visitors)	1	2	3	4	5	N/A
4d.	Size of patient rooms	1	2	3	4	5	N/A
4e.	Layout of patient rooms	1	2	3	4	5	N/A
4f.	Organisation of medical equipment	1	2	3	4	5	N/A
4g.	Number of patients per room	1	2	3	4	5	N/A
4h.	Degree of contact with patients	1	2	3	4	5	N/A
4i.	Lighting of corridors	1	2	3	4	5	N/A
4j.	Lighting of patient rooms	1	2	3	4	5	N/A
4k.	Lighting of en-suite toilet/bathroom (*if applicable)*	1	2	3	4	5	N/A
4l.	Control over natural light (sunlight)	1	2	3	4	5	N/A
4m.	Control over artificial light	1	2	3	4	5	N/A
4n.	Lighting of staff areas	1	2	3	4	5	N/A
4o.	Medical examination lighting	1	2	3	4	5	N/A
4p.	Daytime noise level	1	2	3	4	5	N/A
4q.	Night-time noise level	1	2	3	4	5	N/A
4r.	Locations to have private conversations	1	2	3	4	5	N/A
4s.	Safety of flooring	1	2	3	4	5	N/A
4t.	Ability to move equipment/patients	1	2	3	4	5	N/A
4u.	Ease of cleaning floors or walls	1	2	3	4	5	N/A
4v.	Treatment rooms	1	2	3	4	5	N/A
4w.	Tutorial rooms	1	2	3	4	5	N/A

Q5. **How satisfied are you with the <u>Staff Base</u> as a space to:** *(Please circle **one** response for each item.)*

		Very Unsatisfied		*Neutral*		*Very Satisfied*	*Can't Say*
5a.	Write-up charts, make phone calls, view X-rays	1	2	3	4	5	N/A
5b.	Monitor arrivals and departures of patients/visitors	1	2	3	4	5	N/A
5c.	Talk privately with other staff members	1	2	3	4	5	N/A

Q6. **How satisfied are you with the <u>Equipment / Stores Area</u> in terms of:** *(Please circle **one** response for each item.)*

		Very Unsatisfied		*Neutral*		*Very Satisfied*	*Can't Say*
6a.	Location	1	2	3	4	5	N/A
6b.	Size	1	2	3	4	5	N/A
6c.	Layout	1	2	3	4	5	N/A

Q7. **How would you rate your *personal satisfaction* with the following features of the built environment?** *(Please circle **one** response for each item.)*

		Very Unsatisfied		*Neutral*		*Very Satisfied*	*Can't Say*
7a.	Size of staff tea room	1	2	3	4	5	N/A
7b.	Quality of staff tea room	1	2	3	4	5	N/A
7c.	Garden/Outdoor areas	1	2	3	4	5	N/A
7d.	Number of staff bathroom facilities	1	2	3	4	5	N/A
7e.	Size of staff bathroom facilities	1	2	3	4	5	N/A
7f.	Size of patient bathroom facilities	1	2	3	4	5	N/A
7g.	Space for personal belongings	1	2	3	4	5	N/A
7h.	Presence of artwork	1	2	3	4	5	N/A
7i.	Colour scheme of ward	1	2	3	4	5	N/A
7j.	Physical condition of ward	1	2	3	4	5	N/A
7k.	Patient's ability to control windows	1	2	3	4	5	N/A
7l.	Amount of natural light in ward	1	2	3	4	5	N/A
7m.	Amount of natural light in staff tea room	1	2	3	4	5	N/A
7n.	Freshness of air	1	2	3	4	5	N/A
7o.	Odours	1	2	3	4	5	N/A
7p.	Ability to control air temperature	1	2	3	4	5	N/A
7q.	Patient's ability to control ventilation	1	2	3	4	5	N/A

Q8. **How would you rate your *personal satisfaction* with the following features of the built environment?** *(Please circle **one** response for each item.)*

		Very Unsatisfied				*Very Satisfied*	*Can't Say*
8a.	Aesthetic appeal of flooring	1	2	3	4	5	N/A
8b.	Comfort of flooring	1	2	3	4	5	N/A
8c.	Glare of flooring/surfaces	1	2	3	4	5	N/A
8d.	Cleanliness of floors/countertops	1	2	3	4	5	N/A
8e.	Cleanliness of toilets/bathrooms	1	2	3	4	5	N/A
8f.	Frequency of cleaning	1	2	3	4	5	N/A
8g.	Cleaning regime	1	2	3	4	5	N/A
8h.	Presence of wayfinding signs in ward	1	2	3	4	5	N/A
8i.	Legibility of wayfinding signs in ward	1	2	3	4	5	N/A

Q9. **How *satisfied do you feel patients* are with the following elements of the built environment?** *(Please circle **one** response for each item.)*

		Very Unsatisfied				*Very Satisfied*	*Can't Say*
9a.	Room size/layout	1	2	3	4	5	N/A
9b.	Room occupancy	1	2	3	4	5	N/A
9c.	Aesthetic appeal	1	2	3	4	5	N/A
9d.	Windows	1	2	3	4	5	N/A
9e.	Lighting	1	2	3	4	5	N/A
9f.	Air quality/temperature	1	2	3	4	5	N/A
9g.	Noise level	1	2	3	4	5	N/A
9h.	Flooring/surfaces	1	2	3	4	5	N/A
9i.	Signs/wayfinding aids	1	2	3	4	5	N/A
9j.	Cleanliness	1	2	3	4	5	N/A
9k.	Entertainment/activities	1	2	3	4	5	N/A
9l.	Security	1	2	3	4	5	N/A

Thank you for completing this survey! Please check that you have answered all questions.

Again, thank you for your assistance. Your feedback will help the Department of Human Services to incorporate staff requirements into future healthcare facilities.

Prepared by: Laura Baldassari, Michael Caputo, Molly Conforte, Christopher Werner, © 2005

Staff Satisfaction Surveys – Major Categories

Q1, Q2, Q3: N/A

Q4.

4a.	*Room size*	Number of beds in ward
4b.	*Ward layout*	Ratio of single to double to four bed rooms
4c.	*Ward layout*	Layout of ward (ability to monitor patients/visitors)
4d.	*Room size*	Size of patient rooms
4e.	*Room size*	Layout of patient rooms
4f.	*Ward layout*	Organisation of medical equipment
4g.	*Room size*	Number of patients per room
4h.	*Control*	Degree of contact with patients
4i.	*Lighting*	Lighting of corridors
4j.	*Lighting*	Lighting of patient rooms
4k.	*Lighting*	Lighting of en-suite toilet/bathroom
4l.	*Lighting & Control*	Control over natural light (sunlight)
4m.	*Lighting & Control*	Control over artificial light
4n.	*Lighting*	Lighting of staff areas
4o.	*Lighting*	Medical examination lighting
4p.	*Noise*	Daytime noise level
4q.	*Noise*	Night-time noise level
4r.	*Noise*	Locations to have private conversations
4s.	*Flooring*	Safety of flooring
4t.	*Flooring*	Ability to move equipment/patients
4u.	*Cleanliness*	Ease of cleaning floors or walls
4v.	*Ward layout*	Treatment rooms
4w.	*Ward layout*	Tutorial rooms

Q5.

5a.	*Ward layout*	Write-up charts, make phone calls, view X-rays
5b.	*Ward layout*	Monitor arrivals and departures of patients/visitors
5c.	*Noise*	Talk privately with other staff members

Q6.

6a.	*Ward layout*	Location
6b.	*Ward layout*	Size
6c.	*Ward layout*	Layout

Q7.

7a.	*Ward layout*	Size of staff tea room
7b.	*Ward layout*	Quality of staff tea room

7c.	*Positive distractions*	Garden/Outdoor areas
7d.	*Ward layout*	Number of staff bathroom facilities
7e.	*Ward layout*	Size of staff bathroom facilities
7f.	*Ward layout*	Size of patient bathroom facilities
7g.	*Ward layout*	Space for personal belongings
7h.	*Aesthetics & Positive distractions*	Presence of artwork
7i.	*Aesthetics*	Colour scheme of ward
7j.	*Aesthetics*	Physical condition of ward
7k.	*Control & Windows*	Patient's ability to control windows
7l.	*Windows*	Amount of natural light in ward
7m.	*Windows*	Amount of natural light in staff tea room
7n.	*Ventilation*	Freshness of air
7o.	*Ventilation*	Odours
7p.	*Control*	Ability to control air temperature
7q.	*Control*	Patient's ability to control ventilation
Q8.		
8a.	*Flooring*	Aesthetic appeal of flooring
8b.	*Flooring*	Comfort of flooring
8c.	*Flooring*	Glare of flooring/surfaces
8d.	*Cleanliness*	Cleanliness of floors/countertops
8e.	*Cleanliness*	Cleanliness of toilets/bathrooms
8f.	*Cleanliness*	Frequency of cleaning
8g.	*Cleanliness*	Cleaning regime
8h.	*Wayfinding*	Presence of wayfinding signs in ward
8i.	*Wayfinding*	Legibility of wayfinding signs in ward
Q9.		
9a.	*Room size*	Room size/layout
9b.	*Room size*	Room occupancy
9c.	*Aesthetics*	Aesthetic appeal
9d.	*Windows*	Windows
9e.	*Lighting*	Lighting
9f.	*Ventilation*	Air quality/temperature
9g.	*Noise*	Noise level
9h.	*Flooring*	Flooring/surfaces
9i.	*Wayfinding*	Signs/wayfinding aids
9j.	*Cleanliness*	Cleanliness
9k.	*Positive distractions*	Entertainment/activities
9l.	*Room size*	Security

B.2 BUILDING EVALUATION TOOL

(Document begins on next page).

DHS Building Evaluation Tool

Hospital Name: _____

Ward/Unit ID: _____

Ward Type: _____

Date Completed: _____

Researchers: _____

_____

Ward Profile	Select	#	YES	NO	☒	1	2	3	4	5
Total beds in ward:		( )								
Number of single rooms:		( )								
Single rooms w/ en-suite bath:		( )								
Number of double rooms:		( )								
Double rooms w/ en-suite bath:		( )								
Number of rooms >2 beds:		( )								
Rooms >2 beds w/ en-suite bath:		( )								
Number of isolation rooms:		( )								
If above values cannot be obtained, estimate room type percentages:										
% Single rooms in ward:		( )								
% Double rooms in ward:		( )								
% Rooms >2 beds in ward:		( )								
% Isolation rooms in ward:		( )								
Distance										
Staff base - furthest patient room (m):		( )								
Staff base - furthest general room (m):		( )								
Beds in view of nursing station:		( )								

Ward Aesthetics	Select	#	YES	NO	☒	1	2	3	4	5
Patient Room										
Presence of artwork:			YES	NO						
Noticeable colour scheme:			YES	NO						
If YES, rate attractiveness of colour scheme:										
(1 - random/poor : 5 - highly coordinated/appealing)						1	2	3	4	5
Predominant wall colour:										
Rate visual order:										
(1 - high clutter : 5 - low clutter throughout)						1	2	3	4	5
Hallways/Reception Areas										
Presence of artwork:			YES	NO						
Noticeable colour scheme:			YES	NO						
Rate colour scheme:										
(1 - random/poor : 5 - highly coordinated/appealing)						1	2	3	4	5
Predominant wall colour:										
Rate visual order:										
(1 - high clutter : 5 - low clutter throughout)						1	2	3	4	5
Significant presence of equipment			YES	NO						
Staff Base										
Presence of artwork:			YES	NO						
Noticeable colour scheme:			YES	NO						
Rate colour scheme:										
(1 - random/poor : 5 - highly coordinated/appealing)						1	2	3	4	5
Predominant wall colour:										
Rate visual order:										
(1 - high clutter : 5 - low clutter throughout)						1	2	3	4	5

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Flooring/Surfaces	Select	#	YES	NO		1	2	3	4	5
Room Flooring Material										
Sheet vinyl:	( )									
Vinyl tiles:	( )									
Linoleum:	( )									
Ceramic:	( )									
Rubber:	( )									
Carpet:	( )									
Other:										
Rate friction level:										
(1 - slippery : 3 - ideal : 5 - laboured mobility)						1	2	3	4	5
Rate perception of flooring wear:										
(1 - very worn : 5 - new)						1	2	3	4	5
Recessed/Depressed texturing:			YES	NO						
Ward Flooring Material										
Vinyl:	( )									
Linoleum:	( )									
Ceramic:	( )									
Rubber:	( )									
Carpet:	( )									
Other:										
Rate Friction level:										
(1 - slippery : 3 - ideal : 5 - laboured mobility)						1	2	3	4	5
Rate perception of flooring wear:										
(1 - very worn : 5 - new)						1	2	3	4	5
Recessed/Depressed texturing:			YES	NO						
Central Bathroom Flooring Material										
Vinyl:	( )									
Linoleum:	( )									
Ceramic:	( )									
Rubber:	( )									
Other:										

Room Size	Select	#	YES	NO		1	2	3	4	5
Patient Room Size										
Room type: (1=single, 2=double, etc.)		( )	( )	( )	( )					
Dimensions --										
Length (m):		( )	( )	( )	( )					
Width (m):		( )	( )	( )	( )					
Ceiling height (m):		( )	( )	( )	( )					
Ratio - length : width:		( )	( )	( )	( )					
Allocation of Ward Space										
Patient accommodation (% of total area):		( )								
Staff work area (% of total area):		( )								
Staff amenities (% of total area):		( )								
Visitor amenities (% of total area):		( )								
Circulation space (% of total area):		( )								
Area for personal effects security (patients):			YES	NO						
Area for personal effects security (staff):			YES	NO						
Staff Base										
Dimensions --										
Length (m):		( )								
Width (m):		( )								
Ceiling height (m):		( )								
Ratio - length : width:		( )								

Lighting	Select	#	YES	NO	1	2	3	4	5
Patient Room Lighting									
Lux level (measured):		( )							
Note weather and time of day:									
Type of lighting (select one) --									
Fluorescent:	( )								
Incandescent:	( )								
Halogen:	( )								
Sodium:	( )								
Other:									
Individual reading light:			YES	NO					
Examination lighting:			YES	NO					
Ability to block hallway light:			YES	NO					
Hallway/Reception Lighting									
Lux level (measured):		( )							
Type of Lighting (select one) --									
Fluorescent:	( )								
Incandescent:	( )								
Halogen:	( )								
Sodium:	( )								
Other:									
Night lighting program:			YES	NO					
Staff Base Lighting									
Lux level (measured):		( )							
Note weather and time of day:									
Type of lighting (select one) --									
Fluorescent:	( )								
Incandescent:	( )								
Halogen:	( )								
Sodium:	( )								
Other:									
Individual light sources:			YES	NO					
Night lighting program:			YES	NO					

Noise	Select	#	YES	NO	1	2	3	4	5
Decibel Levels									
Patient room --									
Morning:		( )							
Afternoon:		( )							
Night:		( )							
General ward --									
Morning:		( )							
Afternoon:		( )							
Night:		( )							
Staff Base --									
Morning:		( )							
Afternoon:		( )							
Night:		( )							
Source(s) of Intrusive Noise (check all that apply)									
External --									
Construction:	( )								
Traffic:	( )								
Other:									
Internal: Ward --									
Staff:	( )								
Phone/intercom system:	( )								
Medical equipment:	( )								
Other:									
Internal: Room --									
Other patients:	( )								
Staff:	( )								
Visitors:	( )								
Medical equipment:	( )								
Other:									

Windows	Select	#	YES	NO	☒	1	2	3	4	5
Number per patient per room (avg):		( )								
Dimensions --										
Length (cm):		( )								
Height (cm):		( )								
Height from floor to sill (cm):		( )								
Rate cleanliness:										
(1 - immediate need for cleaning : 5 - totally clean)						1	2	3	4	5
Presence of blinds:			YES	NO						
Single-pane window:		( )								
Double-pane window:		( )								
Visible from window (check all that apply) --										
Sky:		( )								
Ground:		( )								
Interesting human activity:		( )								
Mundane human activity:		( )								
Metropolitan activity:		( )								
Nature:		( )								
Views from bed --										
Room type: (1=single, 2=double, etc.)		( )	( )	( )	( )					
# beds w/ full view from window:		( )	( )	( )	( )					
# beds w/ partial view from window:		( )	( )	( )	( )					
# beds w/ no view from window:		( )	( )	( )	( )					
Source of fresh air ventilation (openable):			YES	NO						
If YES, rate flow of fresh air:										
(1 - no perception of fresh air : 5 - optimum amount)						1	2	3	4	5
If NO, explain:										
DOES NOT allow passage of air:		( )								
Allows passage, but is blocked:		( )								
Poor placement/orientation:		( )								

Vent. System/Air Quality	Select	#	YES	NO	☒	1	2	3	4	5
Presence of air filtration system:			YES	NO						
Percentage of outside air:		( )								
Air exchange rate (per hour):		( )								
Rate presence of odours:										
(1 - no odours, fresh : 5 - overwhelming smells)						1	2	3	4	5
Manner of Air Return (select one)										
Ducted return:		( )								
Open/Ceiling return:		( )								
Isolation rooms										
Number with positive pressure:		( )								
Number with negative pressure:		( )								

Wayfinding	Select	#	YES	NO	☒	1	2	3	4	5
Text Dimensions										
Ward text height (cm):		( )								
Ward Signage										
Rate ease of signage visibility and legibility:										
(1 - very difficult to identify : 5 - clearly visibly/identifiable)						1	2	3	4	5
Rate consistency of signage:										
(1 - numerous types/styles : 5 - uniform signage theme)						1	2	3	4	5
Rate placement of signage:										
(1 - difficult to locate/identify : 5 - clearly visible throughout)						1	2	3	4	5
Signs provided in more than 1 language:			YES	NO						
Usage of graphic signage:			YES	NO						
Rate intuitativeness of graphic signage:										
(1 - confusing/direction unclear : 5 - plainly comprehensible)						1	2	3	4	5

Control	Select	#	YES	NO	☒	1	2	3	4	5
Temperature										
Patient control of temperature:			YES	NO						
If YES, immediate:			YES	NO						
Lighting										
Patient control of room lighting:			YES	NO						
If YES, immediate:			YES	NO						
Patient control of personal lighting:			YES	NO						
If YES, immediate:			YES	NO						
Windows										
Patient control of open/close:			YES	NO						
If YES, immediate:			YES	NO						
Patient control of blinds:			YES	NO						
If YES, immediate:			YES	NO						
Privacy										
Patient control of bed curtain:			YES	NO						
If YES, immediate:			YES	NO						
If multiple-bed room --										
Control over external intrusions:			YES	NO						
If YES, immediate:			YES	NO						
Entertainment										
Presence of a television:			YES	NO						
Patient control of TV:			YES	NO						
If YES, immediate:			YES	NO						
Patient control of music:			YES	NO						
If YES, immediate:			YES	NO						
Communication										
Immediate access to telephone:			YES	NO						
Immediate access to intercom/nurse call:			YES	NO						
Elements lacking control measures:										

Positive Distractions	Select	#	YES	NO	☒	1	2	3	4	5
Patient Room										
Presence of --										
Television:			YES	NO						
Audio system:			YES	NO						
Internet access:			YES	NO						
Communal patient area:			YES	NO						
Staff Base										
Audio system:			YES	NO						
Personal internet access (non-intranet):			YES	NO						
Access to the Outdoors										
Staff:			YES	NO						
Patients:			YES	NO						
If YES, rate the ease of access:										
(1 - very complex route : 5 - simple + clear route)						1	2	3	4	5
Nature										
Rate the indoor natural elements:										
(1 - none : 5 - lush gardens)						1	2	3	4	5
Rate the outdoor elements:										
(1 - cityscape : 5 - botanical landscape)						1	2	3	4	5
General IT Information										
Rate the level of IT use (by apparent # of PCs):										
(1 - no computers : 5 - very many computers)						1	2	3	4	5

Sanitation/Cleanliness	Select	#	YES	NO	☒	1	2	3	4	5
Handwash Facilities										
Total number in ward:		( )								
Percentage within rooms:		( )								
Number delegated only to staff:		( )								
% hands-free operation:		( )								
Seated accessibility:			YES	NO						
Deep enough to prevent splashing:			YES	NO						
Bathroom Facilities										
Rate size of (bathroom):										
(1 - cramped/uncomfortable : 5 - spacious)						1	2	3	4	5
Rate ease of access to (bathroom):										
(1 - very difficulty/awkward : 5 - effortless)						1	2	3	4	5
If restricted to seated mobility --										
Rate ease of using bath accessories (toilet paper, light controls, etc):										
(1 - impossible to use : 5 - effortless use)						1	2	3	4	5
Cleaning										
Type of cleaning service (select one) --										
In-house:		( )								
Contracted:		( )								
Frequency (per day):		( )								
Clean before next patient arrival			YES	NO						
Rate apparent ward cleanliness:										
(1 - dirty : 5 - immaculate)						1	2	3	4	5
Rate apparent patient room cleanliness:										
(1 - dirty : 5 - immaculate)						1	2	3	4	5

Additional Comments and Findings

Appendix C: Royal Melbourne Hospital Data

C.1 ASSESSED WARD BUILDING PLANS

Figure 20: Ward 6 North floor plan

C.2 DESCRIPTION OF THE EXISTING BUILT ENVIRONMENT

Ward ID – 6 North
Ward Type – acute adult inpatient
Date(s) of Evaluation – (1) 12/4/2005, (2) 19/4/2005

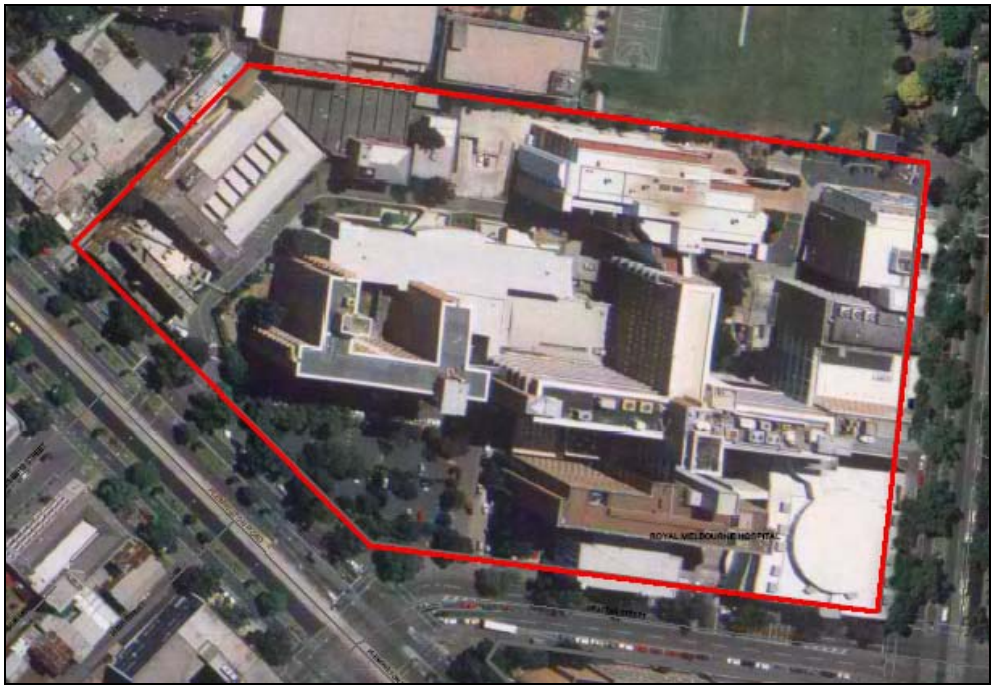

Figure 21: Aerial view of Royal Melbourne Hospital

C.2.1 Facility Background

Royal Melbourne Hospital (RMH) is the leading Level six tertiary teaching hospital managed by Melbourne Health. A Level six tertiary teaching hospital offers the highest level of medical services in the state of Victoria. "The RMH provides a range of general medical and surgical services to people living in Melbourne's northern and western communities. Through its state-wide and specialist programs, including cardiac, neurosciences, oncology, trauma services and the Victorian Infectious Diseases Service, it also serves rural Victoria and interstate regions" (Melbourne Health, 2005). The campus (see Figure 21 and Figure 22) is located on Grattan Street in Parkville, approximately one to two kilometres north of Melbourne's Central Business District. RMH was founded in 1848, and attempted to establish affiliations with various medical research foundations. Today, many of these foundations choose to co-locate with the hospital itself. RMH has also worked to establish "solid teaching foundations in all health disciplines with a range of educational institutes, including The University of Melbourne" (Melbourne Health, 2005).

Figure 22: Front view of Royal Melbourne Hospital

C.2.2 Hospital Contacts

Infrastructure Services (hospital level) – Brian Pope

The general contact for RMH is Brian Pope, Infrastructure Services Manager. Brian obtained CEO approval, identified a ward meeting study specifications, and initiated contact with the ward's nurse unit manager, Rodney Reader. In addition, Brian answered numerous unobservable design questions needed to complete the building evaluation. Finally, Brian provided plans detailing the existing ward, which were useful when calculating room sizes and percentages of allocated ward space.

Nurse Unit Manager (ward level) – Rodney Reader

Within 6 North, the ward examined, Rodney Reader was our main source of information. As the nurse unit manager for the ward, Rodney offered information regarding the patient population of the ward and perceptions of staff attitude. He also identified patients capable of satisfaction survey participation. The staff survey was also facilitated by Rodney's efforts – four surveys were left for completion by the shifts working during our data collection periods. Two additional surveys were given to Rodney to have completed by the night shift. He volunteered to collect them and have them ready for return at the time of our second ward visit.

Two other individuals helped to facilitate the collection of the quantitative health indicators. The Pharmacy Director, Nicholas Jones, gathered information regarding the usage of

analgesics for the ward being assessed. Wendy Tomlinson of the Information Services department was able to provide patient length of stay data for 6 North.

C.2.3 Ward Background

Floor six of the Royal Melbourne Hospital is home to units characterised as "Special Medicine Wards." Ward 6 North, such a unit, is an acute adult inpatient ward. A majority of its patients are elderly individuals in constant need of care or unable to procure a bed at a nursing or aged-care home. During periods of average activity, the patient-to-staff ratio is four to one. At night, this ratio changes to approximately six to one. Ward 6 North, the oldest ward in the hospital, lacks a patient lift system of any kind.

C.2.4 Ward Profile

Ward 6 North houses 28 beds: four single rooms and six quads. There are two behavioural isolation rooms, but no medical rooms are suited for the isolation of an infected or immunocompromised individual. None of the patient rooms have en-suite bathrooms; 85% of the patients live in quads and 15% live in behavioural isolation rooms or single rooms.

C.2.5 Ward Layout

- Single corridor (see Figure 23), with a central staff base located deep inside (approximately 70% of the total distance into the ward)
- Patient rooms extend to extremes of the corridor
- Greatest distance from staff base to patient room = 21 m
- Greatest distance from staff base to general-purpose room = 24.3 m
- Dirty/clean utilities rooms found close to midpoint of corridor
- Unisex patient bathroom/shower area found at both ends of corridor

Figure 23: Looking into Ward 6 North

C.2.6 Ward Aesthetics

- Artwork prevalent in both the staff base (several pictures and a decorative latticework visible on the balcony) and corridor (medium-sized pictures hanging approximately five to eight metres apart)
- Area outside behavioural isolation rooms lacks any visual stimuli
- Patient rooms lack artwork

Figure 24: Corridor artwork and decorative lattice (outside staff base)

Staff Base Aesthetics. The colour scheme of the staff base is moderately attractive. The overall colour is yellow, with walls painted a softer shade. Floor coverings and wall colour are relatively coordinated (dark tan tiles and soft yellow walls). Matching moulding helps to improve the appearance of the base colouring scheme. The colours themselves are not attractive, and the high gloss paints used, although reducing cleaning efforts, reveal greater area in need of cleaning. There is a moderate amount of clutter in the base, as shown in Figure 25. Two counters are kept clear, and areas surrounding computers are kept organised. However, a counter for manual entry of data is littered with postings, forms, and paperwork in transit. In addition, the corkboards are overflowing with information.

Figure 25: Staff base clutter

Corridor Aesthetics. The light blue colour scheme of the corridor is moderately attractive. Again, the moulding and walls match. However, the tile and wall colours clash (dark tan and

blue). Here, too, a high-gloss paint is used. Choosing a single colour for all major surfaces does not increase the aesthetic appeal of the corridor. As seen in Figure 26, there is a significant presence of equipment in the hallway. Approximately eight to twelve chair-sized pieces of equipment line the corridor at various intervals. The majority of these obstructions are found in close proximity to the staff base. The single-corridor design of the ward creates a more apparent presence of equipment.

Figure 26: Example of equipment in hallway

Patient Room Aesthetics. A predominantly tan colour scheme exists in each patient room; however, the scheme is unattractive – tan walls clash with green privacy curtains and blue bed linens. Rooms are of relatively high order: little clutter is visible, individual items have specified locations around the bed, and corkboards allocate space for important patient information.

C.2.7 Flooring/Surfaces

A consistent flooring material is used in patient rooms, the staff base, and the corridor – dark tan vinyl tiles, seen in Figure 27. The flooring material is conducive to walking and the movement of equipment when completely dry. If the surface is wet, however, it becomes a slip hazard. Tiles appear to have a moderate amount of wear; several sections around doorframes are scratched and missing corners, but the tiles have yet to pit or degrade.

Figure 27: General flooring material

Central Bath Flooring. The flooring material in central baths consists of large white linoleum sheets. These surfaces are not textured, nor do they have depressions or recessed areas (depressions hold liquid after being mopped; this liquid can harbour bacteria and pathogens).

C.2.8 Room Size

1. The ward consists of single rooms and quads.
2. The dimensions of the quad rooms are as follows:

   Length (parallel to direction of main corridor) = 6.03 m
   Width = 5.44 m

   - The ratio of length to width for the quad rooms is 6.03:5.44 = 1.108; these rooms are almost square.
3. The dimensions of the single rooms are as follows:

   Length (parallel to direction of main corridor) = 3.02 m
   Width = 5.44 m

   - The ratio of length to width for the single rooms is 3.015:5.44 = 0.554; these rooms are half as long as the quad rooms, and their narrow nature makes mobility slightly more difficult.
4. The dimensions of the staff base (see Figure 28) are as follows:

   Length = 5.10 m
   Width = 5.40 m

   - The ratio of length to width for the staff base is 5.1:5.4 = 0.94; almost square.
5. The ceiling height throughout the ward is 2.95 m.

Figure 28: Staff base, computer area

Ward Space Allocation. Percentages of total available ward space:

- 58.7 % allocated for *patient accommodation* (all patient rooms, all bathrooms for patients, and a shared tea room)
- 11.3% allocated for *staff work* (staff base and isolated meeting room)
- 3.6 % allocated for *visitor amenities* (shared tea room)
- 17.3% allocated for *circulation* throughout the ward (the main corridor only)

Belongings Security. A bedside cabinet (Figure 29) with several drawers has been allocated for the security of personal belongings within patient rooms. A ward-level security system for patient items is not in place. Staff members have been offered individual lockers for security of their belongings.

Figure 29: Bedside cabinet for patients

C.2.9 Lighting

Patient Room Lighting. Assessed at 11:30 a.m.

- Patient room is relatively sunny and bright
- Fluorescent lights illuminate the room
- Individual lights (above each bed on an adjustable fixture) play a dual role – a reading light and an examination light (see Figure 30)
- Patients make use of their security curtain to block out a majority of hallway light

Figure 30: Individual light above patient beds

Main Corridor Lighting. Assessed at 11:30 a.m.

- Area was noticeably dim despite the presence of large, individual fluorescent light fixtures
- Lighting creates considerable amount of glare on the glossy vinyl tile floor
- No night-time lighting program exists

Staff Base Lighting. Assessed at 10:00 a.m.

- Well lit due to combination of overhead fluorescent lighting and a large, glass door leading to balcony
- Base stations lack individual, adjustable light sources
- Has a night-time lighting program (adjustable overhead lighting levels)

C.2.10 Noise

We were unable to measure decibel levels throughout the ward. Ideally, morning, afternoon, and evening decibel levels would have been assessed within patient rooms, the staff base, and the main corridor.

Within patient rooms, a variety of noises are distinguishable:

- *External sources of intrusive noise* – sounds of construction (machinery, hammering, larger vehicles)
- *Internal ward sources of intrusive noise* – sounds of staff members and of the phone/intercom system; the intercom is especially intrusive, producing a raspy, broken sound
- *Internal room sources of intrusive noise* – sounds made by other patients (visitors, coughing, etc.)

C.2.11 Windows

- Approximately 0.66 windows exist per patient per room

- Windows are distributed throughout the ward as follows:
  - Single rooms with one window
  - Quads with two windows
  - Quads with three windows
  - Central baths with two large windows
  - Staff base with two windows/door

- Windows throughout the ward are of identical shape and size:
  - Length (parallel to floor) = 1.0 m
  - Height = 1.75 m
  - Height from sill to floor = 1.00 m

Window Characteristics. The windows are moderately clean; a majority of the glass is covered by dust from construction. Natural light from each window is controlled by a manually operated shade (a chain extends the vertical length of the window). This shade is heavy, and operation may be difficult for an elderly individual. Windows are double-pane and able to slide upwards, providing a five to ten centimetre opening. Due to the orientation of the building and the surrounding construction, such an opening provides a rather inadequate amount of air that is free of particulates.

Views. Rooms of Ward 6 North have eastern or western views.

- *East View* - several buildings, all-glass corridors, and some intermittent traffic along a distant road (sky and mundane human activity, no views of nature, the ground, metropolitan activity, or interesting human activity); see Figure 31.

Figure 31: View from the east side of ward

- *West View* – Similar to the east side – buildings, a major roadway; see Figure 32.

Figure 32: View from the west side of ward

Single Room View – Patients in single rooms have full view from a seated position in bed.

Quad View – All eastern-oriented quad rooms have an obstructed view due to the presence of a wrap-around, outdoor balcony. This balcony prevents patients from seeing the ground and/or elements of lower elevation. Western-oriented quad rooms have a mix of full- and partial-views. The two beds closest to the window banks have full views, whereas the other two beds have only partial views.

C.2.12 Ventilation System/Air Quality

- Ward has Category II, or secondary air filtration
- Approximately 50% of air filtered and pumped into the rooms/corridor is outside air
- Air exchanged at a rate of five times per hour

Odours. Odours are a prevalent component of ward atmosphere. A pungent or offensive odour can permeate the staff base, surrounding patient rooms, and approximately 75% of the corridor in an extremely short period (approximately five to ten minutes). With this particular ward, to eliminate such an odour, the smell has to be allowed to escape from its original location and, thus, affect others.

Ward 6 North has ceiling/corridor air return (air leaves patient rooms through doorways and returns to the filtration system via the main and adjoining corridors). As previously stated, the isolation rooms are behavioural isolation rooms only. Therefore, an advanced filtration or air exchange system is not used in these rooms. Neither room utilises a positive/negative pressure system (positive – air is input into the room via the pressure system; negative – air from within the room is exhausted entirely).

C.2.13 Wayfinding

Signage Utilisation. Signage is used in the main corridor, staff base, and utility areas of the ward. Ward sign text is four and a half centimetres in height, with important graphic symbols five to eight centimetres tall, as seen in Figure 33.

Figure 33: Ward signage

Signage Legibility. Ward signage is fairly visible and legible. Larger, black, block letters are used for text and placed against a white or cream background, helping the words stand out. The signage might benefit from a slight increase in text height.

Signage Consistency. Consistency of signage is poor; the ward lacks a uniform signage theme. The two different text thicknesses used are confusing. In addition, rooms on the left side of the corridor are numbered according to a different system than rooms on the right side. For example, a left-side room sign states "N 607 – 1-4", where "N 607" is both smaller and thinner than "1-4". A similar right-side room sign states only "9-12" in uniform, larger text.

Signage Placement. The placement of signs rates at fairly good to excellent. Important signs are hung from the middle of the main corridor just above one's line of sight. This draws one's attention to signs, but does not make it difficult to identify objects or locations further down the hallway. Room numbering signage is located at the midpoint of the top doorframe section, or directly left of the doorframe at approximately eye level (for a person of average to below-average height).

Graphical Signage. With the exception of the standard handicapped symbol (a person in a wheelchair) and the universal male and female symbols, no additional graphical signage is found in the ward. An example of a "female" bathroom symbol is seen in Figure 34.

Figure 34: Use of graphical signage

Sign Language(s). Signage is provided only in English. Although this reflects poorly upon ward wayfinding, it should be noted that the hospital services department provides individuals with translators for numerous languages, with offices near the main lobby.

C.2.14 Patient Control

- Patients *do NOT have control* over the following elements:
  - Temperature
  - Overhead lighting
  - System for music entertainment

- Patients *have control* over the following measures, but *control is not immediate*:
  Note – the term "immediate" refers to a patient being able to exercise control from a supine position in bed.
  - Bed curtain (privacy)
  - Windows
  - Blinds

- Patients have *immediate control* over the following measures:
  - Intercom/nurse call system
  - Individual lighting

Note – Patients do not have individual access to a telephone. Instead, a cordless phone located in the staff base is available to patients and visitors.

Television. Televisions are not a standard component of 6 North patient rooms, but a television-for-hire service is available for patients. Because of the hiring service, televisions have a minimal ward presence (building evaluation states they are not present). If a patient chooses to hire a television, it is so small that only one person can view the picture at a time. Patients do not have the option of using their own television during longer hospital stays. Due to the sensitive nature of ward electronics and the potential for electronic interference, cable/antenna connections are not available in patient rooms

C.2.15 Positive Distractions

Patient/Visitor Amenities. Rooms do not provide the patient a great degree of positive distraction – rooms lack artwork, audio systems, and Internet access. As previously mentioned, televisions are available for hire. In quadruple-bed rooms, there is no communal area for mobile patients to socially interact. The ward houses a patient/staff/visitor tearoom, which is located at one end of the main corridor. A patient of limited mobility would find it difficult to make an unassisted trip to this area.

Staff Amenities. The staff base has a simple audio system. In addition, computers at the base are configured to allow musical playback. Staff members are granted access to the Internet from these computers for personal, non- work-related use as well. Five to six computers are in constant use over the course of the day.

Figure 35: Staff/patient/visitor tea room

Outdoors Access. Staff members have access to the outdoors – a door at the back of the staff base leads to a balcony that extends along the entire eastern and northern walls. Here, staff can view several plants and a decorative lattice, with access to a communal outdoor sitting area (chairs and a small table) and moderately fresh air (dust due to construction). If a staff member wishes to venture to the grounds below, they must ride in a lift and walk 50-60 metres to an exit. Patients do not have access to the outdoors (balcony or otherwise).

Indoor Natural Elements. Indoor natural elements (plants, fountains, etc.) do not exist. Staff members have views of outdoor plants from the staff base. Patients do not interact with or view natural elements. Around the RMH campus, natural elements are lacking – other buildings, access roads, and construction sites surround a majority of the building. The hospital is surrounded by a typical cityscape (industry, roads, commercial areas, etc).

C.2.16 Sanitation/Cleanliness

There are two types of ward handwash facilities:

1. Standard sink facilities (seen in Figure 36) with sanitary solutions.

Figure 36: One of three handwash sinks

2. Alcohol-solution hand cleanser stations – a component of a hydro-free handwash program called "DeBug." As shown in Figure 37, there are dispensers stationed throughout the ward and posters detailing examples of usage of this sanitary system. In many cases, these posters are accompanied by a wall-mounted pump bottle dispensing an alcohol-based, quick-drying cleaning solution.

Figure 37: "DeBug" sanitation/handwash system with solution dispenser

Handwash Facility Characteristics. The ward has ten total handwash facilities – three sinks and seven alcohol-solution stations. No handwash facilities are located within patient rooms. The sinks have extended handles that can be manipulated by one's elbows and the alcohol-solutions stations require no contact after the initial dispensing of cleaning liquid.

Central Bath Characteristics. Central baths contain handwash facilities for patients. These sinks allow for seated access; however, they are not designed deep enough to prevent splashing. The central bathrooms are of moderate size, comprised of four areas – a toilet, handicapped accessible toilet, shower, and handicapped shower area. The handicapped shower is large enough to accommodate two people, one seated and one assisting. However, if a third person is required to move the seated individual out of the bathroom, the area might become cramped and inadequate. The other shower is large enough for two persons to easily manoeuvre (see Figure 38).

Figure 38: Shower in central bath

The handicapped toilet as seen in Figure 39 is situated in the corner of the stall, making it accessible only on one side. The individual stall is an extremely tight fit for someone of less mobility, such as those requiring a walker. Another challenge presented to those of less mobility is accessing the flushing mechanism which is located in an elevated position at the back of the toilet.

Figure 39: Handicapped accessible toilet in central bath

Accessibility of Bath Handwashing Facilities. For those individuals requiring a wheelchair, accessing handwashing facilities may be difficult. One has to reach extremely far to access paper towels from a wall-mounted dispenser. The hot and cold handles of the sink are poorly designed. Their four-spoke design makes finite control of water flow and pressure more difficult and the handles themselves are mounted on the back of the sink.

Cleaning Service. An in-house cleaning service is used in 6 North. General ward areas (staff base, all floors, corridor surfaces, handwash sinks, etc.) are cleaned once a day. The bathrooms are cleaned twice each day. A spill or accident may require additional cleaning to ensure the safety and comfort of both patients and staff.

General Ward Cleanliness. General ward areas (staff base, meeting room(s), tearoom, etc.) are moderately clean. Floors appear clean, but worn. Windows are in need of cleaning, as are many of the interior glass surfaces. Countertops throughout the ward are frequently wiped down, although there are a few areas where liquids build up (areas of disposal, dirty utilities areas). No sharps are found carelessly misplaced in the general ward areas (due to the presence of sharps protective receptacles).

General Patient Room Cleanliness. Patient rooms appear clean (see Figure 40). Surfaces near patient beds are kept clean and dry for safety reasons. Linens are changed immediately after the release of a patient. Walls, light fixtures, and chairs for visitors are kept clean (no residue on walls, chairs are in good condition and clear of debris, no insects can be seen in or around light fixtures, etc.).

Figure 40: Patient quad room – bed, visitor chair, bedside cabinet

C.3 PATIENT SATISFACTION DATA

Aesthetics							Average	Standard Deviation
Presence of artwork	4	N/A	3		2	3	*3.00*	*1.00*
Colour scheme of the hospital interior	3	3	2	2	2	3	*2.40*	*0.55*
Physical condition of room	4	4	2	2	2	3	*2.80*	*1.10*
Overall tidiness of the hospital environment	3	4	3			4	*3.33*	*0.58*

Room Size								
Size of Room	3	4	4	5	4	4	*4.00*	*0.63*
Layout of room	3	4	4	5	3	3	*3.67*	*0.82*
Size and ease of use of bathroom facility	1	3	4	5	4	3	*3.33*	*1.37*
Space/security for your belongings in room	3	3	4	5	2	2	*3.17*	*1.17*
Space for visitors in your room	2	4	2	4	3	2	*2.83*	*0.98*
Number of patients in your room	3	4	2	4	3	3	*3.17*	*0.75*
Amount of personal space	N/A	4	3	4	4	3	*3.60*	*0.55*
Level of privacy in your room	4	4	1		3	4	*3.20*	*1.30*

Lighting								
Lighting of hallways	4	4	4		3	4	*3.80*	*0.45*
Lighting of your room	3	4	4	3	2	3	*3.17*	*0.75*
Ability to control different types of lighting in room	4	4	4	5	2	4	*3.83*	*0.98*
Lighting of en-suite toilet/washroom	N/A	4	N/A	N/A	2	3	*3.00*	*1.00*

Noise								
Daytime noise level	4	4	4	2	2	4	*3.33*	*1.03*
Night-time noise level	3	4	4	4	2	3	*3.33*	*0.82*
Ability to rest or sleep in your room	4	4	4	3	2	4	*3.50*	*0.84*
Medical Equipment	NO	NO	NO	NO	YES	NO		
Other patients/roommates	NO	NO	YES	YES	YES	YES		
External noise	YES	NO	NO	NO	NO	NO		
Use of bathrooms	NO	NO	NO	NO	NO	NO		
Meal delivery	NO	NO	NO	NO	NO	NO		
Staff	NO	NO	NO	NO	NO	YES		
Telephones	NO	NO	NO	NO	NO	NO		
Cleaners	NO	NO	NO	NO	NO	NO		
Visitors	NO	NO	NO	NO	YES	NO		
Other	NO	NO	YES	NO	NO	NO		

Windows							Average	Standard Deviation
View out of window from bed?	Yes	Yes	Yes	Yes	Yes	Yes		
Ability to see out of your window	4	2	2	5	1	4	*3.00*	*1.55*
Quality of view from your window	4	2	2	5	N/A	2	*3.00*	*1.41*
Amount of natural light through your window	4	4	4		2	4	*3.60*	*0.89*
Control over natural light (sunlight)	3	4	4	3	2	4	*3.33*	*0.82*

Ventilation System/Air Quality								
Freshness of air in your room	4	4	4	3	4	4	*3.83*	*0.41*
Existence of odours in your room	4	4	2	3	3	3	*3.17*	*0.75*
Air temperature in your room	3	4	2	4	3	4	*3.33*	*0.82*
Control over temperature	N/A	N/A	N/A	4	2	3	*3.00*	*1.00*
Control over natural ventilation (fresh air)	3	N/A	4	3	3	4	*3.40*	*0.55*

Cleanliness								
Cleanliness of floors/benchtops	5	4	3	5	3	4	*4.00*	*1.00*
Cleanliness of toilets/washrooms	N/A	4	3	5	3	3	*3.75*	*0.96*

Flooring/Surfaces								
Safety and comfort of flooring	2	4	2	5	3	4	*3.33*	*1.21*
Lighting glare produced by hospital surfaces	3	4	3	5	N/A	4	*3.80*	*0.84*

Wayfinding								
Presence of signs to help you find your way around	4	4	1		1	4	*2.80*	*1.64*
Legibility of signs to help you find your way around	N/A	4	1		1	4	*2.50*	*1.73*

Control								
Nurse call system	4	N/A	3	5	2	N/A	*3.50*	*1.29*
Control over natural light (sunlight)	3	4	4	3	2	4	*3.20*	*0.84*
Ability to control different types of lighting in room	4	4	4	5	2	4	*3.80*	*1.10*
Control over temperature	N/A	N/A	N/A	4	2	3	*3.00*	*1.41*
Control over natural ventilation (fresh air)	3	N/A	4	3	3	4	*3.25*	*0.50*

Positive Distractions							Average	Standard Deviation
Level of social interaction	4	N/A	3		3	4	*3.50*	*0.58*
Degree of contact with staff	4	4	4	5	3	2	*3.67*	*1.03*
Presence of artwork	4	N/A	3		2	3	*3.00*	*0.82*
Television access	2	N/A	1	N/A	1	3	*1.75*	*0.96*
Access to telephone	3	4	4	5	3	2	*3.50*	*1.05*
Entertainment activities	N/A	N/A	N/A	N/A	2	N/A	*2.00*	*N/A*
Accessibility to outdoors	3	4	4	N/A	1	4	*3.20*	*1.30*
Quality of garden/outdoor area	3	N/A	N/A	N/A	N/A	1	*2.00*	*1.41*
Nature	4	3	5	3	5	3	*3.83*	*0.98*
Sky	2	3	5	5	4	4	*3.83*	*1.17*
Buildings	4	3	2	5	3	2	*3.17*	*1.17*
Ground	3	3	2	3	3	4	*3.00*	*0.63*
Human activity	5	3	4	3	3	5	*3.83*	*0.98*
Locational clues	4	3		3	3	2	*3.00*	*0.71*

C.4 STAFF SATISFACTION DATA

Aesthetics						Average	Standard Deviation
Personal - Presence of artwork	2	3	2	2	2	*2.20*	*0.45*
Personal - Colour scheme of ward	2	1	1	1	2	*1.40*	*0.55*
Personal - Physical condition of ward	1	1	1	1	1	*1.00*	*0.00*
Patient Opinion - Aesthetic appeal	2	2	1	1	1	*1.40*	*0.55*

Room Size							
Delivery - Number of beds in ward	3	4	3	3	3	*3.20*	*0.45*
Delivery - Size of patient rooms	2	2	1	2	4	*2.20*	*1.10*
Delivery - Layout of patient rooms	2	3	1	2	4	*2.40*	*1.14*
Delivery - Number of patients per room	4	2	N/A	3	4	*3.25*	*0.96*
Patient Opinion - Room size/layout	2	3	2	2	4	*2.60*	*0.89*
Patient Opinion - Room occupancy	2	1	2	2	2	*1.80*	*0.45*
Patient Opinion - Security	3	4	3	3	2	*3.00*	*0.71*

Lighting							
Delivery - Lighting of corridors	4	4	2	3	3	*3.20*	*0.84*
Delivery - Lighting of patient rooms	4	4	1	2	1	*2.40*	*1.52*
Delivery - Lighting of en-suite toilet/bathroom	3	4	N/A	N/A	2	*3.00*	*1.00*
Delivery - Control over natural light	3	3	1	3	1	*2.20*	*1.10*
Delivery - Control over artificial light	3	3	2	2	2	*2.40*	*0.55*
Delivery - Lighting of staff areas	2	4	2	2	3	*2.60*	*0.89*
Delivery - Medical examination lighting	N/A	3	3	3	1	*2.50*	*1.00*
Patient Opinion - Lighting	2	3	2	2	2	*2.20*	*0.45*

Noise							
Delivery - Daytime noise level	2	3	3	3	2	*2.60*	*0.55*
Delivery - Night-time noise level	4	3	2	2	1	*2.40*	*1.14*
Delivery - Locations to have private conversations	3	2	1	2	1	*1.80*	*0.84*
Staff base - talk privately	4	2	2	2	1	*2.20*	*1.10*
Patient Opinion - Noise level	2	2	1	1	2	*1.60*	*0.55*

Windows						Average	Standard Deviation
Personal - Patient's ability to control windows	N/A	2	1	1	1	*1.25*	*0.50*
Personal - Amount of natural light in ward	3	2	3	3	3	*2.80*	*0.45*
Personal - Amount of natural light in staff tea room	3	2	2	2	1	*2.00*	*0.71*
Patient Opinion - Windows	2	3	2	1	3	*2.20*	*0.84*

Ventilation System/Air Quality							
Personal - Freshness of air	4	3	2	2	1	*2.40*	*1.14*
Personal - Odours	3	3	1	1	1	*1.80*	*1.10*
Patient Opinion - Air quality/temperature	3	3	1	1	2	*2.00*	*1.00*

Cleanliness							
Delivery - Ease of cleaning floors or walls	4	3	2	2	1	*2.40*	*1.14*
Personal - Cleanliness of flooring/surfaces	3	2	1	1	1	*1.60*	*0.89*
Personal - Cleanliness of toilets/bathrooms	2	1	1	1	1	*1.20*	*0.45*
Personal - Frequency of cleaning	4	1	1	1	1	*1.60*	*1.34*
Personal - Cleaning regime	4	1	2	1	1	*1.80*	*1.30*
Patient Opinion - Cleanliness	3	2	1	1	1	*1.60*	*0.89*

Flooring/Surfaces							
Delivery - Safety of flooring	3	3	2	3	2	*2.60*	*0.55*
Delivery - Ability to move equipment/patients	3	2	2	3	1	*2.20*	*0.84*
Personal - Aesthetic appeal of flooring	3	1	1	1	1	*1.40*	*0.89*
Personal - Comfort of flooring	3	3	1	1	2	*2.00*	*1.00*
Personal - Glare of flooring/surfaces	3	3	1	1	1	*1.80*	*1.10*
Patient Opinion - Flooring/surfaces		2	2	2	3	*2.25*	*0.50*

Wayfinding							
Personal - Presence of wayfinding signs in ward	3	3	2	2	2	*2.40*	*0.55*
Personal - Legibility of wayfinding signs in ward	4	3	2	2	2	*2.60*	*0.89*
Patient Opinion - Signs/wayfinding aids	3	3	3	2	2	*2.60*	*0.55*

Control						Average	Standard Deviation
Delivery - Degree of contact with patients	4	3	3	3	4	*3.40*	*0.55*
Delivery - Control over natural light	3	3	1	3	1	*2.20*	*1.10*
Delivery - Control over artificial light	3	3	2	2	2	*2.40*	*0.55*
Personal - Patient's ability to control windows	N/A	2	1	1	1	*1.25*	*0.50*
Personal - Ability to control temperature	2	3	1	1	1	*1.60*	*0.89*
Personal - Patient's ability to control ventilation	2	2	1	1	1	*1.40*	*0.55*

Positive Distractions							
Personal - Garden/outdoor areas	N/A	1	2	1	1	*1.25*	*0.50*
Personal - Presence of artwork	2	3	2	2	2	*2.20*	*0.45*
Patient Opinion - Entertainment/activities	3	2	1	1	1	*1.60*	*0.89*

C.5 BUILDING EVALUATION DATA

(Document begins on next page).

Hospital - Royal Melbourne Hospital *Ward ID* - 6 North *Ward Type* - adult acute inpatient	Pre-Renovation Date of evaluation: (12/04/2005)	Post-Renovation Date of evaluation: (##/##/#####)
Ward Profile		
Total beds in ward:	28	
Number of single rooms:	4	
Single rooms w/ en-suite bath:	0	
Number of double rooms:	0	
Double rooms w/ en-suite bath:	0	
Number of rooms >2 beds:	6	
Rooms >2 beds w/ en-suite bath:	0	
Number of isolation rooms:	2	
% Single rooms in ward:	7.14	
% Double rooms in ward:	0	
% Rooms >2 beds in ward:	85.71	
% Isolation rooms in ward:	7.14	
Distance		
Staff base - furthest patient room (m):	21	
Staff base - furthest general room (m):	24.3	
Beds in view of nursing station:	3	
Ward Aesthetics		
Patient Room		
Presence of artwork:	NO	
Noticeable colour scheme:	YES	
If YES, rate attractiveness of colour scheme:		
(1 - random/poor : 5 - highly coordinated/appealing)	2	
Predominant wall colour:	BEIGE	
Rate visual disorganisation:		
(1 - high clutter : 5 - low clutter throughout)	4	
Hallways/Reception Areas		
Presence of artwork:	YES	
Noticeable colour scheme:	YES	
Rate colour scheme:		
(1 - random/poor : 5 - highly coordinated/appealing)	3	
Predominant wall colour:	BLUE	
Rate visual disorganisation:		
(1 - high clutter : 5 - low clutter throughout)	3	
Significant presence of equipment	YES	
Staff Base		
Presence of artwork:	YES	
Noticeable colour scheme:	YES	
Rate colour scheme:		
(1 - random/poor : 5 - highly coordinated/appealing)	3	
Predominant wall colour:	YELLOW	
Rate visual disorganisation:		
(1 - high clutter : 5 - low clutter throughout)	3	

Flooring/Surfaces	
Room Flooring Material	
Select flooring material:	VINYL TILE
Rate friction level:	
(1 - slippery : 3 - ideal : 5 - laboured mobility)	2
Rate perception of flooring wear:	
(1 - very worn : 5 - new)	3
Recessed/Depressed texturing:	NO
Hallway Flooring Material	
Select flooring material:	VINYL
Rate Friction level:	
(1 - slippery : 3 - ideal : 5 - laboured mobility)	2
Rate perception of flooring wear:	
(1 - very worn : 5 - new)	3
Recessed/Depressed texturing:	NO
Central Bathroom Flooring Material	
Select flooring material:	LINOLEUM
Room Size	
Patient Room	
Room type (select one) --	SINGLE
Dimensions --	
Length (m):	3.015
Width (m):	5.44
Ceiling height (m):	2.95
Ratio - length : width:	0.554
Room type (select one) --	>2 BEDS
Dimensions --	
Length (m):	6.03
Width (m):	5.44
Ceiling height (m):	2.95
Ratio - length : width:	1.108
Room type (select one) --	SINGLE
Dimensions --	
Length (m):	N/A
Width (m):	N/A
Ceiling height (m):	N/A
Ratio - length : width:	N/A
Allocation of Ward Space	
Patient accommodation (% of total area):	58.7
Staff work area (% of total area):	11.3
Visitor amenities (% of total area):	3.6
Circulation space (% of total area):	17.3
Area for personal effects security (patients):	NO
Area for personal effects security (staff):	YES
Staff Base	
Dimensions --	
Length (m):	5.1
Width (m):	5.4
Ceiling height (m):	2.95
Ratio - length : width:	0.94

Lighting	
Patient Room Lighting	
Lux level (measured):	N/A
Note weather and time of day:	Sunny, 11:30 a.m.
Type of lighting (select one) --	FLUORESCENT
Individual reading light:	YES
Examination lighting:	YES
Ability to block hallway light:	YES
Hallway/Reception Lighting	
Lux level (measured):	N/A
Type of Lighting (select one) --	FLUORESCENT
Night lighting program:	NO
Staff Base Lighting	
Lux level (measured):	N/A
Type of lighting (select one) --	FLUORESCENT
Individual light sources:	NO
Night lighting program:	YES
Noise	
Decibel Levels	
Patient room --	
Morning:	N/A
Afternoon:	N/A
Night:	N/A
General ward --	
Morning:	N/A
Afternoon:	N/A
Night:	N/A
Source(s) of Intrusive Noise (check all that apply)	
External --	
Construction:	☑
Traffic:	☐
Other:	☐
Internal: Ward --	
Medical equipment:	☐
Phone/intercom system:	☑
Staff:	☑
Other:	☐
Internal: Room --	
Other patients:	☑
Staff:	☐
Visitors:	☐
Other:	☐

Windows	
Number per patient per room (avg):	0.66
Dimensions --	
Length (cm):	1
Height (cm):	1.75
Height from floor to sill (cm):	1
Rate cleanliness:	
(1 - immediate need for cleaning : 5 - totally clean)	3
Presence of blinds:	YES
Single-pane window:	NO
Double-pane window:	YES
Visible from window (check all that apply) --	
Sky:	☑
Ground:	☐
Interesting human activity:	☐
Mundane human activity:	☑
Metropolitan activity:	☐
Nature:	☐
# beds in room:	1
# beds w/ full view from window:	1
# beds w/ partial view from window:	0
# beds w/ no view from window:	0
# beds in room:	4
# beds w/ full view from window:	4
# beds w/ partial view from window:	0
# beds w/ no view from window:	0
# beds in room:	N/A
# beds w/ full view from window:	N/A
# beds w/ partial view from window:	N/A
# beds w/ no view from window:	N/A
Source of fresh air ventilation (openable):	YES
If YES, rate flow of fresh air:	
(1 - no perception of fresh air : 5 - optimum amount)	2
If NO, explain:	
DOES NOT allow passage of air:	☐
Allows passage, but is blocked:	☐
Poor placement/orientation:	☐
Vent. System/Air Quality	
Presence of air filtration system:	YES
Percentage of outside air:	50
Air exchange rate (per hour):	5
Rate presence of odours:	
(1 - no odours, fresh : 5 - overwhelming smells)	4
Manner of Air Return (select one)	
Ducted return:	☐
Ceiling return:	☑
Isolation rooms	
Positive pressure - #:	0
Negative pressure - #:	0

Wayfinding	
Text Dimensions	
Ward text height (cm):	4.5
Ward Signage	
Rate ease of signage visibility and readability:	
(1 - very difficult to identify : 5 - clearly visibly/identifiable)	4
Rate consistency of signage:	
(1 - numerous types/styles : 5 - uniform signage theme)	2
Rate placement of signage:	
(1 - difficult to locate/identify : 5 - clearly visible throughout)	4
Signs provided in >1 language:	NO
Usage of graphic signage:	NO
Rate intuitativeness of graphic signage:	
(1 - confusing/direction unclear : 5 - plain/comprehensible)	2

Control	
Temperature	
Patient control of temperature:	NO
If YES, immediate:	NO
Lighting	
Patient control of room lighting:	NO
If YES, immediate:	NO
Patient control of personal lighting:	YES
If YES, immediate:	YES
Windows	
Patient control of open/close:	YES
If YES, immediate:	NO
Patient control of blinds:	YES
If YES, immediate:	NO
Privacy	
Patient control of bed curtain:	YES
If YES, immediate:	NO
If multiple-bed room --	
Control over external intrusions:	YES
If YES, immediate:	NO
Entertainment	
Patient control of TV:	NO
If YES, immediate:	NO
Patient control of music:	NO
If YES, immediate:	NO
Communication	
Immediate access to telephone:	NO
Immediate access to intercom/nurse call:	YES
Elements lacking control measures:	

Positive Distractions	
Patient Room	
Presence of --	
Television:	NO
Audio system:	NO
Internet access:	NO
Communal patient area:	NO
Staff Base	
Presence of --	
Audio system:	YES
Personal internet access (non-intranet):	YES
Access to the Outdoors	
Staff:	YES
Patients:	NO
If YES, rate the ease of access:	
(1 - very complex route : 5 - simple + clear route)	1
Nature	
Rate the indoor natural elements:	
(1 - none : 5 - lush gardens)	1
Rate the outdoor elements:	
(1 - cityscape : 5 - botanical landscape)	2
General IT Information	
Rate the level of IT use (by apparent # of PCs):	
(1 - no computers : 5 - very many computers)	3

Sanitation/Cleanliness	
Handwash Facilities	
Total number in ward:	10
Percentage within rooms:	0
Number delegated only to staff:	2
% hands-free operation:	30
Seated accessibility:	YES
Deep enough to prevent splashing:	NO
Bathroom Facilities	
Rate size of (bathroom):	
(1 - cramped/uncomfortable : 5 - spacious)	3
Rate ease of access to (bathroom):	
(1 - very difficulty/awkward : 5 - effortless)	2
If restricted to seated mobility --	
Rate ease of using bath accessories (toilet paper, light controls, etc):	
(1 - impossible to use : 5 - effortless use)	2
Cleaning	
Type of cleaning service (select one) --	
In-house:	☑
Contracted:	☐
Ward cleaning - frequency (per day):	1
Bath cleaning - frequency (per day):	2
Clean before next patient arrival	YES
Rate apparent ward cleanliness:	
(1 - dirty : 5 - immaculate)	3
Rate apparent patient room cleanliness:	
(1 - dirty : 5 - immaculate)	4

C.6 QUANTITATIVE HEALTH INDICATORS DATA

C.6.1 Length of Stay

	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	**Averages**
Average Age	77	73	74	78	73	75	***75.00***
Average LOS, excluding HITH	9.82	9.03	7.81	9.26	10.74	10.18	***9.47***
Separations	105	107	128	91	98	116	***107.50***

C.6.2 Administered Medication

	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	**Averages**
Mild Analgesics							
Paracetamol (mg)	970000	1458000	1259600	649200	869600	1220000	***1071067.0***
Panadeine (mg)	0	0	0	0	0	0	***0.00***
Moderate Analgesics							
Panadeine Forte (mg)	0	0	0	0	0	0	***0.00***
Tramadol (mg)	0	7000	5000	4000	0	8000	***4000.00***
Potent Analgesics							
Oxycodone (mg)	1100	1200	600	200	1000	600	***783.33***
Morphine (mg)	2000	1600	1600	1700	5000	3500	***2566.67***

C.6.3 Nosocomial Infection

This information could not be obtained from this hospital.

Appendix D: Dandenong Hospital Data

D.1 ASSESSED WARD BUILDING PLANS

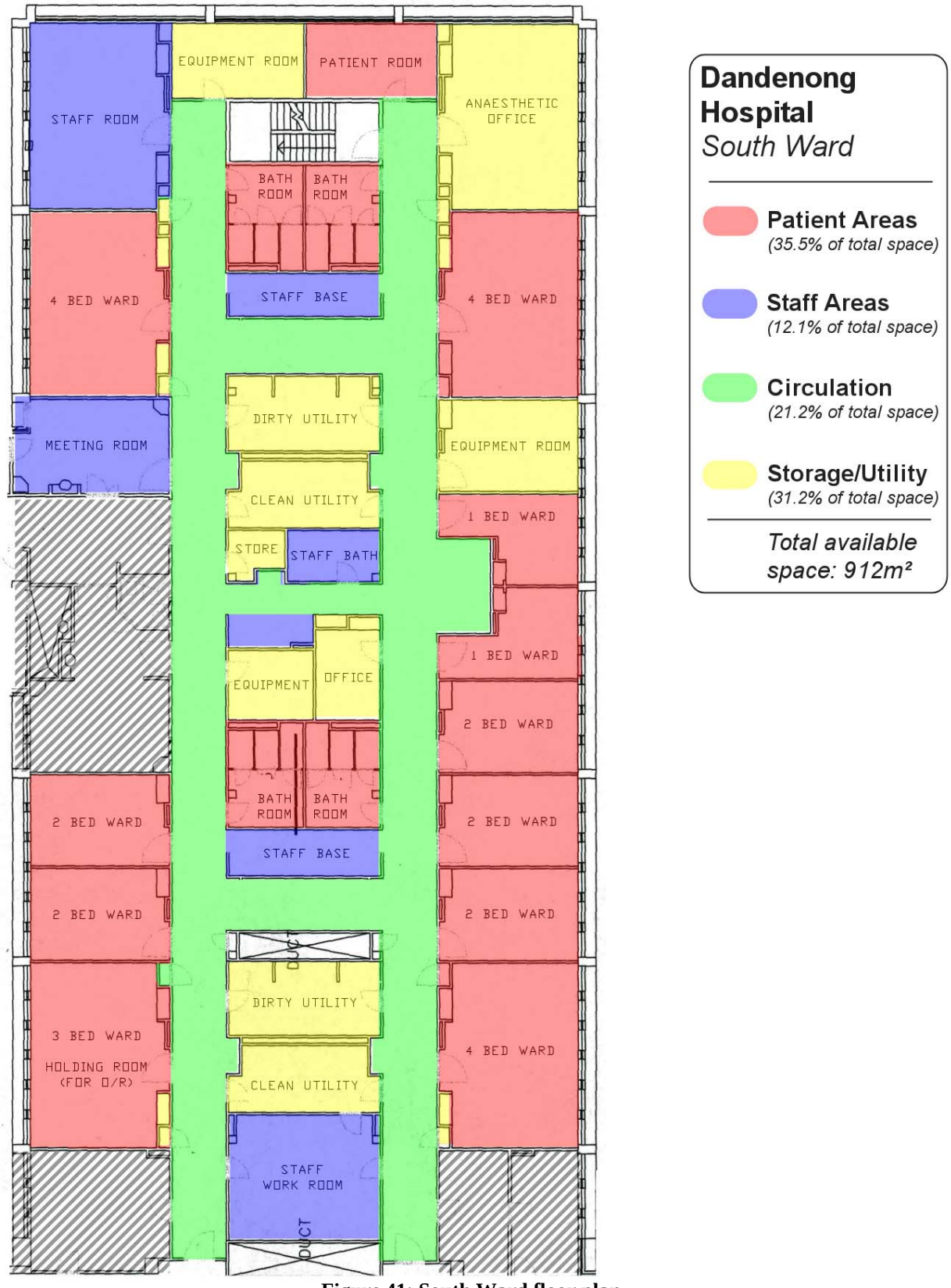

Figure 41: South Ward floor plan

D.2 DESCRIPTION OF THE EXISTING BUILT ENVIRONMENT

Ward ID – South Ward
Ward Type – acute adult inpatient
Dates of Evaluation – (1) 15/4/2005, (2) 19/4/2005

Figure 42: Front view of Dandenong Hospital

D.2.1 Facility Background

Dandenong Hospital, which is managed by Southern Health, is Victoria's eastern-most tertiary hospital. Dandenong Hospital provides: "General medical and surgical services, including orthopaedic services, an intensive care unit, cardiac care unit, rehabilitation and aged services, pathology and radiology, a maternity unit and special care nursery, children's services, allied health services, psychiatric facilities, neurosurgery, thoracic surgery, vascular, plastics, gynaecology, and respiratory" (Southern Health, 2005). The facility (see Figure 42) is located on David Street in Dandenong, Victoria and surrounded by various private, for-profit medical facilities (general practitioners, chiropractors, psychiatrists, etc.) benefiting from the hospital's presence. Dandenong Hospital is considered to be a Level 5 community hospital, implying that educational opportunities are not as abundant as those afforded by a Level 6 teaching hospital. Many of its patrons are of a low socioeconomic status, so the hospital is promoted to a position of heightened civil responsibility – people of the region may be unable to afford the services of a private practice. In addition, the hospital services accommodate patients speaking 29 languages to support the demographics of the area.

D.2.2 Hospital Contacts

Capital Projects and Works (hospital level) – *Wendy McComas*
Wendy served as a general contact during preliminary hospital investigation, taking engineering-specific building evaluation questions to individuals in position to provide answers. She also established contact with Leanne Christie, a valuable operations contact. Wendy's most valuable contribution was her guided facility tour, during which we visited the ward to be examined, South Ward, and also a ward representing the post-renovation physical environment, West Ward. This tour enabled group members to visually confirm their perceptions of existing and renovated conditions drawn from research, interviews, and focus groups. Lastly, Wendy provided plans of the existing ward, which were used in calculation of distances and space allocation.

Site Project Manager (hospital level) – *Leanne Christie*
Following our preliminary visit, Leanne became our general contact. Prior to the first data collection period, Leanne established contact with the nurse unit manager of South Ward, preparing the ward for our visit. Most importantly, Leanne provided patient length of stay statistics for South Ward from July 2003 – March 2005. This information was very important, identifying pertinent statistics that could be isolated and included in the facility assessment. She also had the unfortunate responsibility of informing us that the Dandenong nosocomial infection data collection would not be available due to the manner in which data were collected.

Nurse Unit Manager (ward level) – *Nel Banzon*
Nel identified several patients and staff to participate in our satisfaction survey at the outset of each data period. In addition, she directed us to custodial employees for answers to cleanliness and sanitation questions posed in the building evaluation tool.

D.2.3 Ward Background

South Ward is an acute adult inpatient ward. During periods of average activity, the patient-to-staff ratio is four to one. At night, this ratio changes to approximately six to one. As with other older facilities, South Ward lacks a patient lift system. At one point, South Ward patients and staff were moved to an unoccupied ward while the physical environment underwent minor renovations – a fresh coat of paint and some basic changes to bathroom facilities. A view looking into the ward can be seen in Figure 43.

Figure 43: Looking into South Ward

D.2.4 Ward Profile

South Wards houses 27 beds – two single-bed rooms, five two-bed rooms, three quadruple-bed rooms, and an operating room holding bay with only three beds. The ward contains neither en-suite bathrooms nor isolation rooms.

Figure 44: Storage cabinets in patient rooms; patient bed (lighted); visitor's chair; another example of a patient bed (unlit during daytime hours)

Ward Room Percentages.

Single Rooms = 18%
Double Rooms = 46%
>2 Bed Rooms = 36%
- O.R. Holding Bay = 9%
- Quads = 27%

Isolation Rooms = 0%

D.2.5 Ward Layout

- Two exits to main hospital corridor
- Two staff bases – (1) located 30% and (2) 80% of total distance into ward
- Two parallel corridors with staff bases perpendicular to these corridors, creating a "racetrack" (see Figure 1)
- One large equipment storage area and patient/visitor communal room at southern end
- Extremes of ward are used for staff room/specialised services (O.R. holding room, anaesthetics, surgery)
- Staff room in southeast corner
- Anaesthetic office in southwest corner
- Operating room holding bay in northeast corner
- Four central, unisex patient bathrooms, two on each side of "racetrack", found to either side of staff base
- Two areas for patient movement from one side of "racetrack" to other; four areas restricted to staff movement; eight total areas for side-to-side movement
- Staff tea area in centre of ward
- Greatest distance from staff base to a patient room = 9 meters
- Greatest distance from staff base to a general-purpose room = 13 meters
- Six of twenty-seven beds are visible from staff bases

D.2.6 Ward Aesthetics

- Staff bases and patient rooms lack artwork
- Artwork exists in main corridors – small paintings hung sporadically

Staff Base Aesthetics. The colour scheme of staff bases is fairly unattractive – the predominant green wall colour is unappealing. The walls are painted with high gloss paint, showing all dirt and spills on surfaces. In addition, the paint reflects a good deal of light, adding to the reflection generated by the luminescent ward flooring. Fortunately, approximately 50% of staff base walls are covered by corkboards and white boards for patient listings. There is a relatively low amount of clutter within each base – effective usage of wall space opposite each base (see Figure 45) allows for extraneous postings to be moved outside base areas and frees up valuable countertop space. In addition, sectioning each base into four individual desk areas allows staff members to organise a personal space.

Figure 45: Examples of minimal clutter at the secondary staff base

Corridor/Hallway Aesthetics. The colour scheme and attractiveness of the main corridors are identical to those of the staff bases (see above explanation). Corridors have a moderate amount of clutter. As stated, many of the postings commonly found in a staff base have been moved outside the base. Also, unused supplies occupy a small portion of the hall.

Figure 46: Examples of main corridor artwork

There is not a significant presence of equipment in South Ward corridors – small obstructions are present, but these are regularly moved. The organisation is improved by the presence of various equipment storage areas, as shown in Figure 47.

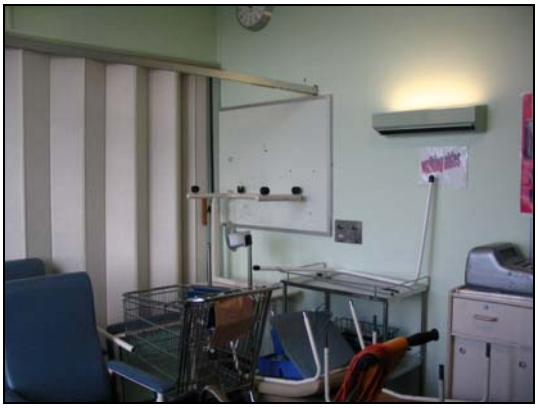

Figure 47: Equipment room at south end of ward

Patient Room Aesthetics. The colour scheme and attractiveness of the patient rooms are identical to those of the staff bases (see "Staff Base Aesthetics" explanation). Patient rooms have a fairly low amount of clutter. The staff help organise patient space, and postings consist only of emergency and important patient-specific information. Individual room clutter is decreased by the adjustable/recessed nature of many of the over-bed accessories (television, light, etc.).

D.2.7 Flooring/Surface

The flooring material used in the main corridors, staff bases, and patient rooms is consistent – dark brown vinyl tiles – as can be seen in Figure 49. When completely dry, the tiles are conducive to both walking and the movement of equipment. If the surface is wet, however, it becomes a slip hazard. Signs are posted throughout the ward reminding staff to ensure that the floors are kept dry and free of obstacles (Figure 48).

Floor surfaces appear slightly worn; tiles are still shiny, scratches less prevalent than one would anticipate for such an old ward, and only smaller defects are noticeable (chipping, small cracks, etc.). These surfaces, however, are slightly recessed. The grout/sealant used has been worn away, and is now at a lower level than that of the tiles. This decay may prove to be an infection risk, as liquid can definitely collect/pool in these porous trenches.

Figure 48: Signage cautioning of spill hazards

Figure 49: Glare from general flooring material used in ward

Central Bath Flooring. Central bath flooring materials consist of large linoleum sheets. These surfaces are not textured, nor do they have depressions or recessed areas.

D.2.8 Room Size

1. South Ward consists of single-, double-, triple-, and quadruple-bed rooms.
2. The dimensions of single-bed rooms are as follows:

   Length (parallel to direction of main corridors) = 3.61 m
   Width = 3.48 m

   - The length-to-width ratio for single rooms is 1.04 – these rooms are approximately square.
3. The dimensions of double rooms are as follows:

   Length (parallel to direction of main corridors) = 3.61 m
   Width = 5.41 m

   - The length-to-width ratio for double rooms is 0.67 – this ratio may restrict staff ability to manoeuvre around the room, especially if there is a significant equipment presence.
4. The dimensions of the triple- (O.R. holding bay) and quadruple-bed rooms are as follows:

   Length (parallel to direction of main corridors) = 7.21 m
   Width = 5.41 m

   - The length-to-width ratio for this room is 1.33 – a staff member may be afforded more open space for manoeuvring.
5. The dimensions of the staff bases are as follows:

   Length (parallel to direction of main corridors) = 1.75 m
   Width = 6.15 m
   Ceiling Height = 2.4 m

   - The length-to-width ratio for staff bases is 0.29 –bases are very narrow and do not accommodate movement from one side of the ward to the opposite.
6. Ceiling height throughout ward (with exception of staff base areas) = 2.9 m.

Figure 50: (left) Staff base; (centre) base interior; (right) secondary base

Ward Space Allocation. Percentages are of total usable ward space.

- 34.0% allocated for *patient accommodation* (all patient rooms, all patient bathrooms, and the common room)
- 7.5% allocated for *staff work* (staff bases, meeting room, and work room)
- 4.6% allocated for *staff amenities* (tea room, personal room)
- 1.5% allocated for *visitor amenities* (common room)
- 21.2% allocated for *circulation* throughout the ward (the main corridors and connecting areas)

Belongings Security. Within patient rooms, a bedside cabinet with several drawers has been allocated for the security of personal belongings (see Figure 51). A ward-level security system for patient items does not exist. It is encouraged that extremely valuable patient belongings be given to security on the main floor, where a safe is located. Staff members have been offered individual lockers in the break broom, as shown in Figure 52 for their security.

Figure 51: Cabinet for patient belongings

Figure 52: Staff lockers

D.2.9 Lighting

Patient Room Lighting. Room lighting assessed at 10:45 a.m. on a sunny day. Provided blinds are open:

- Patient rooms are moderately bright
- Fluorescent lights illuminate the room
- An upward-facing individual light (for reading, personal comfort, etc.) is located above each bed (see Figure 53)
- These individual lights do not serve as examination lighting
- Patients have the ability to block out a large portion of corridor light via privacy curtains
- Room Lux Level = 357.0 lux

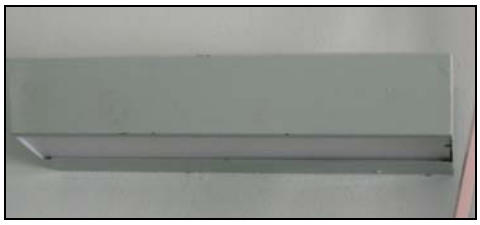

Figure 53: Individual patient light

Corridor Lighting. Corridor lighting assessed at 10:45 a.m. on a sunny day.

- Large individual fluorescent light fixtures
- Becomes quite dim if all patient doors are closed
- Lighting creates considerable amount of glare on the glossy vinyl floor
- Lacks a night-time lighting program
- Corridor Lux Level = 149.2 lux

Staff Base Lighting. Staff base lighting assessed at 10:45 a.m. on a sunny day.

- Lighting relies heavily upon fluorescent overhead light sources, less upon natural light from patient rooms
- Separate staff base stations lack individual light sources
- Lacks a night-time lighting program
- Staff Base Lux Level = 352. 0 lux

D.2.10 Noise

Morning Decibel Levels –

- Patient Rooms = 52 dB
- General Ward Areas = 53 dB
- Staff Base = 60 dB

Afternoon Decibel Levels –

- Patient Rooms = 58 dB
- General Ward Areas = 57 dB
- Staff Base = 61 dB

Note – We were unable to acquire night-time decibel levels for any areas evaluated. Values for morning and afternoon decibel levels were provided by facility staff, not measured by the project group.

In patient rooms, a variety of noises are distinguishable above the *noise ceiling* (extent of noise acceptable due to constant exposure; sounds becomes elements of indistinguishable background noise).

- External sources of intrusive noise – inapplicable; no alarming sounds of construction or traffic are audible (despite the fact that Dandenong was under construction at the time of pre-renovation assessment)
- Internal ward sources of intrusive noise – sounds of staff members (conversations, during periods of excited activity, etc.) and of the phone/intercom system
- Internal room sources of intrusive noise – sounds of visitors

Note – "intrusive" refers to noise distinguishable from sounds of the noise ceiling (see above).

D.2.11 Windows

- Approximately 1.41 windows per patient per room

- Patient rooms are a mix of the following:
    - Single-bed rooms with 2.5 windows (split b/w rooms)
    - Double-bed rooms with 2.5 windows (split b/w rooms)
    - Quadruple-bed rooms with five windows
    - O.R. holding bay with five windows
    - Central bathrooms without windows
    - Staff bases without windows

- Windows throughout the ward are of identical shape and size:
    - Length (parallel to floor) = 0.85 m
    - Height = 2.15 m
    - Height from sill to floor = 0.85 m

Window Characteristics. The windows are moderately clean. Dust from the construction and nearby road/parking lot collects on the outside windows surfaces, but it does not impair the view. Mobile patients, visitors, and staff control the amount of natural light coming through the single-pane windows via blinds. Customarily, one to two windows per room are able to be opened five to ten centimetres to allow for the entrance of fresh air. The hospital sits at the corner of two moderately busy streets, so available air quality is affected as such. The north-eastern windows face a wall of the same building, and all of the western windows face another building. Only the south-eastern windows have uninhibited access to the flow of fresh air.

Views. Rooms of South Ward have either eastern or western views.

- *East View* – sky, ground, a parking lot, another side of the same building, trees nearby, and mountains off in the distance; see Figure 54.

Figure 54: View from the east side of the ward

- *West View* – sky, ground, several other facility buildings, a parking lot, nearby road, etc.; see Figure 55.

Figure 55: View from the west side of the ward

Single-bed Room View – Patients occupying a single-bed room have a full view from a seated position in bed.

Double-bed Room View – Patients with the bed closer to the exterior wall have a full view from a seated position in bed. The other patients (closer to the corridor) have only a partial view from a seated position in bed.

Triple-bed Room View – Patients with the bed closer to the exterior wall have a full view from a seated position in bed. The other patients (closer to the corridor) have only partial views from a seated position in bed.

Quadruple-bed Room View – Patients with beds closest to the exterior wall have full views from seated positions in bed. The other patients (closer to the corridor) have only partial views from a seated position in bed.

D.2.12 Ventilation System/Air Quality

- Ward has an air handling unit for filtration
- The percentage of outside air pumped into ward and the air exchange rate are variable – an economiser control adjusts these variables based on the ambient outside air temperature.

Odours. Overwhelming odours are not a noticeable component of the ward atmosphere. Because of the proximity of patient bathrooms to staff bases, pungent odours from these facilities could affect those working in the base. However, the use of dividers in half the patient bathrooms can serve as a temporary barrier.

South Ward has open/ceiling air return (air leaves patient rooms through doorways and returns to the filtration system via main and adjoining corridors). Because there are no isolation rooms, positive/negative pressure systems are not utilised.

D.2.13 Wayfinding

Signage Utilisation. Signage is found in the main corridors, staff bases, and utility areas. With the exception of the room/bed numbering system, signage is not used in patient rooms. Utility, staff base, and room identification signage is approximately two centimetres in height; an example of this type of signage is shown in Figure 56. The ward's only larger location identification sign is four to six centimetres in height and identifies the nurses station (Figure 57).

Figure 56: Style of common ward signage

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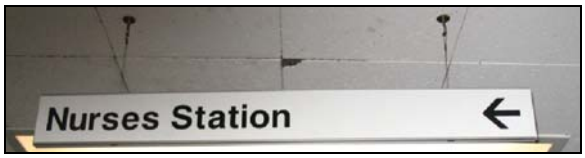

Figure 57: Larger nurse station signage

Signage Legibility. Signage is moderately visible/legible. Signs make use of large, black block letters set against a silver, metallic or white background (the single larger sign). These colour combinations, especially the black with metallic background, help the words stand out. The two-centimetre height of utility and ward signage is acceptable for staff legibility, but this height may be too small for an older patient with vision problems who is attempting to read room numbers.

Signage Placement. Signage placement throughout the ward is less than adequate. There is only one sign hung from the middle of the main corridor. This sign should appear in four separate locations, but only appears in one such place. There is insufficient use of perpendicular sign placement (signs that can be read by a patient/visitor while walking the length of the hall). To find a utility or specific patient room, one must be standing directly in front of a doorway. This design flaw complicates circulation throughout the ward. Reading various signs to find a particular room leads to constant stopping, creating obstacles for staff

members. Beyond this immediate shortcoming, signage placement is acceptable, with placards found in the middle of each door, slightly above eye level.

Signage Theme Consistency. Consistency of the signage theme is average. The ward exhibits a relatively uniform signage theme. Approximately 90% of all signage consists of two-centimetre, black block lettering set against metallic backgrounds. However, there is one sign with larger text, white background, and different location. In addition, not all beds in every room have visible bed-identification letters (A, B, C, or D).

Graphical signage is not used in South Ward. This is a significant shortcoming, due to the multi-lingual nature of the patient demographic. In addition, signs are not provided in a language other than English, making graphical sign usage very important. It is surprising that a hospital offering translation services in 29 languages does not have either extensive graphical signage or a multi-lingual signage program.

D.2.14 Patient Control

- Patients *lack control* over the following measures:
    - Temperature
    - Overhead room lighting
    - System for musical playback

- Patients *have control* over the following measures, but *control is not immediate*:
  Note – the term "immediate" implies a patient is able to exercise control from a seated position in bed.
    - Bed curtain (privacy)
    - Windows
    - Blinds

- Patients have *immediate control* over the following measures:
    - Intercom/nurse call system
    - Individual lighting
    - Television (rental service; televisions attached to overhead, adjustable fixtures)

Note – Patients and visitors do not have immediate, individual access to a telephone. Instead, each staff base provides a phone that can be used; this phone can be seen at the second staff base in Figure 58.

Figure 58: Patient/Visitor phone

D.2.15 Positive Distractions

Patient Amenities. Within rooms, a television-for-hire service offers patients immediate access to a television. Patients do not have either Internet access (anywhere in ward) or access to any type of audio system. Multi-bed rooms do not have internal communal areas. A patient/visitor recreational room is located at the southern end of the ward, where a television (see Figure 59), various reading materials, and more scenic views are available.

Figure 59: Patient room television

Staff Amenities. Neither staff base has an audio system. Computers provide access to the Internet for personal, non- work-related use. A relatively low level of Internet Technology activity takes place in South Ward – four to five personal computers are provided, and only two to three receive constant use over the course of the day. The ward has two staff areas. One is a tea area, connecting the east and west corridors, where staff members can prepare their lunch or simply congregate while remaining relatively close to patients. This area can be seen in Figure 60.

Figure 60: Staff tea area

Another staff room, located in the southeast corner of the ward, contains a computer, television, couches, and lockers for security of personal belongings. Staff members use this space as their personal area; postings and items from various individuals can be seen in Figure 61.

Figure 61: (left) Staff room dining area; (right) staff room entertainment area

Outdoors Access. Neither staff nor patients have immediate access to the outdoors. Staff members have to leave the hospital or travel to one of the new wards to enjoy any outdoor/natural elements. Elements outside the hospital are industrial/community –hospital buildings, smaller community roads, other buildings, parking lots, a limited number of trees, and minimal amounts of human activity. These elements do not constitute a cityscape, but certainly mundane rural backdrops and activity.

Indoor Natural Elements. South Ward has no indoor natural elements.

D.2.16 Sanitation/Cleanliness

There are two types of ward handwash facilities:

1. Standard corridor sink facility with sanitary solution; see Figure 62.

Figure 62: Corridor handwash facility

2. En-suite sinks (one located in each patient room, with the exception of one single room that, due to size and design constraints, lacks an individual handwash facility); see Figure 63.

Figure 63: En-suite sink

Handwash Facility Characteristics. There are 14 handwash facilities in South Ward – four corridor facilities and ten en-suite sinks. Sanitary solution is provided at each facility. None of the sinks accommodate hands-free operation – all utilise handles requiring torsion, or are crowded by handwash accessories. The en-suite sinks allow for seated accessibility. However, the four corridor sinks, which are allocated for staff use, do not afford seated accessibility. None of the fourteen facilities are deep enough to prevent splashing.

Bathroom Facilities. The patient central bath facilities are of nearly ideal spaciousness. Handicapped showers, as shown in Figure 64, accommodate a patient and up to two staff members for assistance. Shower facilities lack solid dividers, giving the room a more open feel and affording a larger area for manoeuvrability.

Figure 64: Handicapped shower facility

These bathrooms place the sink, handicapped toilet, and handicapped shower facilities in proximity to each other, while preserving space in the middle of the room for patient assistance. Bathroom access is relatively poor. Certain bathrooms have stalls in place, making unassisted access more difficult for patients with limited motor functions. Handicapped toilets have access from both sides; however, the amount of space allocated on each side of the toilet is inadequate. There is barely enough room to fit a trash bin between the toilet and the rail (see Figure 66); a staff member attempting to offer assistance to a patient would find the task rather difficult. Figure 65 and Figure 66 show two different types of handicapped accessible toilets.

Figure 65: (right) Individual handicapped accessible toilet
Figure 66: (left) Handicapped accessible toilet (sharing space with shower)

The bathroom sinks are not conducive to elderly patient usage (see Figure 67) – handles require torsion. Bathroom hardware utilising hands-free levers would be much better for such individuals. For seated or handicapped individuals, everything is conveniently located, except for paper towels, which would be moderately difficult to reach.

Figure 67: Central bathroom sink

Cleaning Service. An in-house cleaning service is used in South Ward. Both bathrooms and general ward areas are cleaned once a day. If an accident occurs, unlimited cleaning services are available. All immediate patient areas, such as bed linens and countertop surfaces, are cleaned before the arrival of the next patient.

General Ward Cleanliness. South Ward general cleanliness was relatively poor (at the time of assessment). There were several spills that had yet to be marked or mopped. Several dirt piles were waiting to be swept up. In addition, a used patient gown had been left on the floor in one of the patient bathrooms. It has been noted that this ward, South Ward, has approximately twice the general ward area as RMH's 6 North to keep clean.

General Apparent Patient Room Cleanliness. Patient rooms appear very clean. Surfaces immediate to patient beds are kept clean and dry for safety reasons. Linens are changed immediately after the release of a patient. Walls, light fixtures, and chairs for visitors are kept very clean; there is no residue on walls, chairs are in good condition and clear of debris, and no insects are in light fixtures.

D.3 PATIENT SATISFACTION DATA

Aesthetics							Average	Standard Deviation
Presence of artwork	N/A	N/A	2	3	2	3	*2.50*	*0.58*
Colour scheme of the hospital interior	4	3	4	3	3	3	*3.33*	*0.52*
Physical condition of room	3	3	4	4	2	2	*3.00*	*0.89*
Overall tidiness of the hospital environment	4	4	4	4	3	2	*3.50*	*0.84*

Room Size								
Size of Room	2	2	5	5	4	4	*3.67*	*1.37*
Layout of room	4	3	5	5	4	4	*4.17*	*0.75*
Size and ease of use of bathroom facility	2	3	4	5	3	3	*3.33*	*1.03*
Space/security for your belongings in room	5	4	4	5	4	4	*4.33*	*0.52*
Space for visitors in your room	3	2	4	2	3	4	*3.00*	*0.89*
Number of patients in your room	4	2	5	5	4	3	*3.83*	*1.17*
Amount of personal space	3	2	4	4	4	4	*3.50*	*0.84*
Level of privacy in your room	3	3	3	4	3	4	*3.33*	*0.52*

Lighting								
Lighting of hallways	4	4	5	4	3	3	*3.83*	*0.75*
Lighting of your room	3	4	5	4	3	4	*3.83*	*0.75*
Ability to control different types of lighting in room	4	3	4	3	N/A	3	*3.40*	*0.55*
Lighting of en-suite toilet/washroom	N/A	N/A	N/A	4	3	N/A	*3.50*	*0.71*

Noise								
Daytime noise level	4	4	4	4	4	3	*3.83*	*0.41*
Night-time noise level	4	4	4	5	4	3	*4.00*	*0.63*
Ability to rest or sleep in your room	4	4	4	5	4	3	*4.00*	*0.63*
Medical Equipment	NO	NO	NO	NO	NO	NO		
Other patients/roommates	NO	YES	NO	NO	NO	NO		
External noise	NO	NO	NO	NO	NO	NO		
Use of bathrooms	NO	NO	NO	NO	NO	NO		
Meal delivery	NO	NO	NO	NO	NO	NO		
Staff	NO	YES	YES	NO	NO	NO		
Telephones	NO	NO	NO	NO	NO	NO		
Cleaners	NO	NO	NO	NO	NO	NO		
Visitors	NO	NO	NO	NO	NO	NO		
Other	NO	NO	NO	YES	NO	NO		

Windows							Average	Standard Deviation
View out of window from bed?	No	Yes	Yes	Yes	No	Yes		
Ability to see out of your window	3	3	4	4	3	4	*3.50*	*0.55*
Quality of view from your window	1	2	4	1	N/A	2	*2.00*	*1.23*
Amount of natural light through your window	3	2	5	5	4	4	*3.83*	*1.17*
Control over natural light (sunlight)	3	4	4	5	3	4	*3.83*	*0.73*

Ventilation System/Air Quality								
Freshness of air in your room	3	4	4	4	3	4	*3.67*	*0.52*
Existence of odours in your room	3	4	5	4	4	4	*4.00*	*0.63*
Air temperature in your room	3	2	4	4	4	4	*3.50*	*0.84*
Control over temperature	N/A	N/A	N/A	N/A	2	N/A	*2.00*	*N/A*
Control over natural ventilation (fresh air)	4	4	N/A	4	2	N/A	*3.50*	*1.00*

Cleanliness								
Cleanliness of floors/benchtops	4	4	4	4	2	2	*3.33*	*1.03*
Cleanliness of toilets/washrooms	4	4	4	4	2	2	*3.33*	*1.03*

Flooring/Surfaces								
Safety and comfort of flooring	4	3	4	4	4	4	*3.83*	*0.41*
Lighting glare produced by hospital surfaces	4	3	4	4	3	N/A	*3.60*	*0.55*

Wayfinding								
Presence of signs to help you find your way around	3	4	4	4	4	4	*3.83*	*0.41*
Legibility of signs to help you find your way around	3	4	4	4	4	4	*3.83*	*0.41*

Control								
Nurse call system	4	N/A	5	4	4	3	*4.00*	*0.71*
Control over natural light (sunlight)	4	3	5	4	4	3	*3.83*	*0.75*
Ability to control different types of lighting in room	3	N/A	3	4	3	4	*3.40*	*0.55*
Control over temperature	N/A	2	N/A	N/A	N/A	N/A	*2.00*	*N/A*
Control over natural ventilation (fresh air)	N/A	2	4	N/A	4	4	*3.50*	*1.00*

Positive Distractions							Average	Standard Deviation
Level of social interaction	4	N/A	5	3	4	2	*3.60*	*1.14*
Degree of contact with staff	5	N/A	5	4	4	4	*4.40*	*0.55*
Presence of artwork	3	2	3	2	N/A	N/A	*2.50*	*0.58*
Television access	N/A	N/A	N/A	N/A	3	4	*3.50*	*0.71*
Access to telephone	2	N/A	4	N/A	3	4	*3.25*	*0.96*
Entertainment activities	2	N/A	N/A	N/A	3	N/A	*2.50*	*0.71*
Accessibility to outdoors	N/A	N/A	N/A	N/A	4	2	*3.00*	*1.41*
Quality of garden/outdoor area	N/A	N/A	N/A	N/A	4	N/A	*4.00*	*N/A*
Nature	5	5	5	5	5	5	*5.00*	*0.00*
Sky	4	4	4	3		4	*3.80*	*0.45*
Buildings	1	2	1	2	1	2	*1.50*	*0.55*
Ground	3	2	1	3	1	3	*2.17*	*0.98*
Human activity	3	2	1	2	3	4	*2.50*	*1.05*
Locational clues	1	2	1		3	3	*2.00*	*1.00*

D.4 STAFF SATISFACTION DATA

Aesthetics					Average	Standard Deviation
Personal - Presence of artwork	3	4	2	3	*3.00*	*0.82*
Personal - Colour scheme of ward	2	3	1	2	*2.00*	*0.82*
Personal - Physical condition of ward	2	2	1	2	*1.75*	*0.50*
Patient Opinion - Aesthetic appeal	2	2	1	2	*1.75*	*0.50*

Room Size						
Delivery - Number of beds in ward	4	3	4	4	*3.75*	*0.50*
Delivery - Size of patient rooms	3	1	1	2	*1.75*	*0.96*
Delivery - Layout of patient rooms	3	2	1	2	*2.00*	*0.82*
Delivery - Number of patients per room	3	3	2	4	*3.00*	*0.82*
Patient Opinion - Room size/layout	2	2	1	2	*1.75*	*0.50*
Patient Opinion - Room occupancy	2	1	1	2	*1.50*	*0.58*
Patient Opinion - Security	4	3	2	3	*3.00*	*0.82*

Lighting						
Delivery - Lighting of corridors	2	3	4	3	*3.00*	*0.82*
Delivery - Lighting of patient rooms	3	3	4	3	*3.25*	*0.50*
Delivery - Lighting of en-suite toilet/bathroom	4	3	1	3	*2.75*	*1.26*
Delivery - Control over natural light	3	4	3	3	*3.25*	*0.50*
Delivery - Control over artificial light	3	3	4	3	*3.25*	*0.50*
Delivery - Lighting of staff areas	2	1	1	3	*1.75*	*0.96*
Delivery - Medical examination lighting	2	2	3	3	*2.50*	*0.58*
Patient Opinion - Lighting	2	2		3	*2.33*	*0.58*

Noise						
Delivery - Daytime noise level	2	2	1	1	*1.50*	*0.58*
Delivery - Night-time noise level	N/A	2	1	3	*2.00*	*1.00*
Delivery - Locations to have private conversations	2	2	2	3	*2.25*	*0.50*
Staff base - talk privately	2	1	2	3	*2.00*	*0.82*
Patient Opinion - Noise level	3	1	1	1	*1.50*	*1.00*

Windows					Average	Standard Deviation
Personal - Patient's ability to control windows	3	2	1	3	*2.25*	*0.96*
Personal - Amount of natural light in ward	3	2	4	3	*3.00*	*0.82*
Personal - Amount of natural light in staff tea room	2	2	4	2	*2.50*	*1.00*
Patient Opinion - Windows	2	2	4	2	*2.50*	*1.00*

Ventilation System/Air Quality						
Personal - Freshness of air	N/A	1	2	N/A	*1.50*	*0.71*
Personal - Odours	2	2	2	3	*2.25*	*0.50*
Patient Opinion - Air quality/temperature	3	1	1	1	*1.50*	*1.00*

Cleanliness						
Delivery - Ease of cleaning floors or walls	N/A	5	N/A	3	*4.00*	*1.41*
Personal - Cleanliness of flooring/surfaces	4	4	5	3	*4.00*	*0.82*
Personal - Cleanliness of toilets/bathrooms	4	4	5	3	*4.00*	*0.82*
Personal - Frequency of cleaning	3	5	5	3	*4.00*	*1.15*
Personal - Cleaning regime	4	5	5	2	*4.00*	*1.41*
Patient Opinion - Cleanliness	4	4	5	3	*4.00*	*0.82*

Flooring/Surfaces						
Delivery - Safety of flooring	2	2	2	2	*2.00*	*0.00*
Delivery - Ability to move equipment/patients	3	3	1	2	*2.25*	*0.96*
Personal - Aesthetic appeal of flooring	2	3	1	3	*2.25*	*0.96*
Personal - Comfort of flooring	3	1	4	3	*2.75*	*1.26*
Personal - Glare of flooring/surfaces	3	2	5	3	*3.25*	*1.26*
Patient Opinion - Flooring/surfaces	3	2	1	2	*2.00*	*0.82*

Wayfinding						
Personal - Presence of wayfinding signs in ward	3	2	2	3	*2.50*	*0.58*
Personal - Legibility of wayfinding signs in ward	3	2	2	3	*2.50*	*0.58*
Patient Opinion - Signs/wayfinding aids	3	2	1	3	*2.25*	*0.96*

Control					Average	Standard Deviation
Delivery - Degree of contact with patients	3	3	4	3	*3.25*	*0.50*
Delivery - Control over natural light	3	4	3	3	*3.25*	*0.50*
Delivery - Control over artificial light	3	3	4	3	*3.25*	*0.50*
Personal - Patient's ability to control windows	3	2	1	3	*2.25*	*0.96*
Personal - Ability to control temperature	1	1	1	1	*1.00*	*0.00*
Personal - Patient's ability to control ventilation	2	1	1	1	*1.25*	*0.50*

Positive Distractions						
Personal - Garden/outdoor areas	N/A	N/A	1	N/A	*1.00*	*N/A*
Personal - Presence of artwork	3	4	2	3	*3.00*	*0.82*
Patient Opinion - Entertainment/activities	N/A	2	1	1	*1.33*	*0.58*

D.5 BUILDING EVALUATION DATA

(Document begins on next page).

Hospital - Dandenong Hospital *Ward ID* - South Ward *Ward Type* - adult acute inpatient	Pre-Renovation Date of evaluation: (15/4/2005)	Post-Renovation Date of evaluation: (##/##/####)
Ward Profile		
Total beds in ward:	27	
Number of single rooms:	2	
Single rooms w/ en-suite bath:	0	
Number of double rooms:	5	
Double rooms w/ en-suite bath:	0	
Number of rooms >2 beds:	4	
Rooms >2 beds w/ en-suite bath:	0	
Number of isolation rooms:	0	
% Single rooms in ward:	18	
% Double rooms in ward:	46	
% Rooms >2 beds in ward:	36	
% Isolation rooms in ward:	0	
Distance		
Staff base - furthest patient room (m):	9	
Staff base - furthest general room (m):	13	
Beds in view of nursing station:	6	
Ward Aesthetics		
Patient Room		
Presence of artwork:	NO	
Noticeable colour scheme:	YES	
If YES, rate attractiveness of colour scheme:		
(1 - random/poor : 5 - highly coordinated/appealing)	2	
Predominant wall colour:	GREEN	
Rate visual disorganisation:		
(1 - high clutter : 5 - low clutter throughout)	4	
Hallways/Reception Areas		
Presence of artwork:	YES	
Noticeable colour scheme:	YES	
Rate colour scheme:		
(1 - random/poor : 5 - highly coordinated/appealing)	2	
Predominant wall colour:	GREEN	
Rate visual disorganisation:		
(1 - high clutter : 5 - low clutter throughout)	3	
Significant presence of equipment	NO	
Staff Base		
Presence of artwork:	NO	
Noticeable colour scheme:	YES	
Rate colour scheme:		
(1 - random/poor : 5 - highly coordinated/appealing)	2	
Predominant wall colour:	GREEN	
Rate visual disorganisation:		
(1 - high clutter : 5 - low clutter throughout)	4	

Flooring/Surfaces	
Room Flooring Material	
Select flooring material:	VINYL TILE
Rate friction level:	
(1 - slippery : 3 - ideal : 5 - laboured mobility)	2
Rate perception of flooring wear:	
(1 - very worn : 5 - new)	4
Recessed/Depressed texturing:	YES
Hallway Flooring Material	
Select flooring material:	VINYL
Rate Friction level:	
(1 - slippery : 3 - ideal : 5 - laboured mobility)	2
Rate perception of flooring wear:	
(1 - very worn : 5 - new)	4
Recessed/Depressed texturing:	YES
Central Bathroom Flooring Material	
Select flooring material:	LINOLEUM
Room Size	
Patient Room	
Room type (select one) --	SINGLE
Dimensions --	
Length (m):	3.61
Width (m):	3.48
Ceiling height (m):	2.9
Ratio - length : width:	1.04
Room type (select one) --	DOUBLE
Dimensions --	
Length (m):	3.61
Width (m):	5.41
Ceiling height (m):	2.9
Ratio - length : width:	0.67
Room type (select one) --	>2 BEDS
Dimensions --	
Length (m):	7.21
Width (m):	5.41
Ceiling height (m):	2.9
Ratio - length : width:	1.33
Allocation of Ward Space	
Patient accommodation (% of total area):	34
Staff work area (% of total area):	7.5
Staff amenities (% of total area):	4.6
Visitor amenities (% of total area):	1.5
Circulation space (% of total area):	21.2
Area for personal effects security (patients):	NO
Area for personal effects security (staff):	YES
Staff Base	
Dimensions --	
Length (m):	1.75
Width (m):	6.15
Ceiling height (m):	2.4

Lighting	
Patient Room Lighting	
Lux level (measured):	357
Note weather and time of day:	sunny, 10:45 a.m.
Type of lighting (select one) --	FLUORESCENT
Individual reading light:	YES
Examination lighting:	NO
Ability to block hallway light:	YES
Hallway/Reception Lighting	
Lux level (measured):	149.2
Type of Lighting (select one) --	FLUORESCENT
Night lighting program:	NO
Staff Base Lighting	
Lux level (measured):	352
Type of lighting (select one) --	FLUORESCENT
Individual light sources:	NO
Night lighting program:	NO
Noise	
Decibel Levels	
Patient room --	
Morning:	52
Afternoon:	58
Night:	N/A
General ward --	
Morning:	58
Afternoon:	57
Night:	N/A
Staff Base --	
Morning:	60
Afternoon:	61
Night:	N/A
Source(s) of Intrusive Noise (check all that apply)	
External --	
Construction:	☐
Traffic:	☐
Other:	☐
Internal: Ward --	
Medical equipment:	☐
Phone/intercom system:	☑
Staff:	☑
Other:	☐
Internal: Room --	
Other patients:	☐
Staff:	☐
Visitors:	☑
Other:	☐

Windows	
Number per patient per room (avg):	1.41
Dimensions --	
Length (cm):	85
Height (cm):	215
Height from floor to sill (cm):	85
Rate cleanliness:	
(1 - immediate need for cleaning : 5 - totally clean)	3
Presence of blinds:	YES
Single-pane window:	YES
Double-pane window:	NO
Visible from window (check all that apply) --	
Sky:	☑
Ground:	☑
Interesting human activity:	☐
Mundane human activity:	☑
Metropolitan activity:	☐
Nature:	☑
# beds in room:	1
# beds w/ full view from window:	1
# beds w/ partial view from window:	0
# beds w/ no view from window:	0
# beds in room:	2
# beds w/ full view from window:	1
# beds w/ partial view from window:	1
# beds w/ no view from window:	0
# beds in room:	4
# beds w/ full view from window:	2
# beds w/ partial view from window:	2
# beds w/ no view from window:	0
Source of fresh air ventilation (openable):	YES
If YES, rate flow of fresh air:	
(1 - no perception of fresh air : 5 - optimum amount)	3
If NO, explain:	
DOES NOT allow passage of air:	☐
Allows passage, but is blocked:	☐
Poor placement/orientation:	☐
Vent. System/Air Quality	
Presence of air filtration system:	YES
Percentage of outside air:	N/A
Air exchange rate (per hour):	N/A
Rate presence of odours:	
(1 - no odours, fresh : 5 - overwhelming smells)	2
Manner of Air Return (select one)	
Ducted return:	☐
Open/ceiling return:	☑
Isolation rooms	
Positive pressure - #:	0
Negative pressure - #:	0

Wayfinding	
Text Dimensions	
Ward text height (cm):	2
Ward Signage	
Rate ease of signage visibility and readability:	
(1 - very difficult to identify : 5 - clearly visibly/identifiable)	3
Rate consistency of signage:	
(1 - numerous types/styles : 5 - uniform signage theme)	3
Rate placement of signage:	
(1 - difficult to locate/identify : 5 - clearly visible throughout)	2
Signs provided in >1 language:	NO
Usage of graphic signage:	NO
Rate intuitativeness of graphic signage:	N/A
(1 - confusing/direction unclear : 5 - plain/comprehensible)	1
Control	
Temperature	
Patient control of temperature:	NO
If YES, immediate:	YES
Lighting	
Patient control of room lighting:	NO
If YES, immediate:	YES
Patient control of personal lighting:	YES
If YES, immediate:	YES
Windows	
Patient control of open/close:	YES
If YES, immediate:	NO
Patient control of blinds:	YES
If YES, immediate:	NO
Privacy	
Patient control of bed curtain:	YES
If YES, immediate:	NO
If multiple-bed room --	
Control over external intrusions:	YES
If YES, immediate:	NO
Entertainment	
Patient control of TV:	YES
If YES, immediate:	YES
Patient control of music:	NO
If YES, immediate:	YES
Communication	
Immediate access to telephone:	NO
Immediate access to intercom/nurse call:	YES
Elements lacking control measures:	

Positive Distractions	
Patient Room	
Presence of --	
Television:	YES
Audio system:	NO
Internet access:	NO
Communal patient area:	YES
Staff Base	
Presence of --	
Audio system:	NO
Personal internet access (non-intranet):	YES
Access to the Outdoors	
Staff:	NO
Patients:	NO
If YES, rate the ease of access:	N/A
(1 - very complex route : 5 - simple + clear route)	1
Nature	
Rate the indoor natural elements:	
(1 - none : 5 - lush gardens)	1
Rate the outdoor elements:	
(1 - cityscape : 5 - botanical landscape)	2
General IT Information	
Rate the level of IT use (by apparent # of PCs):	
(1 - no computers : 5 - very many computers)	2

Sanitation/Cleanliness	
Handwash Facilities	
Total number in ward:	14
Percentage within rooms:	71.4
Number delegated only to staff:	4
% hands-free operation:	0
Seated accessibility:	YES
Deep enough to prevent splashing:	NO
Bathroom Facilities	
Rate size of (bathroom):	
(1 - cramped/uncomfortable : 5 - spacious)	4
Rate ease of access to (bathroom):	
(1 - very difficulty/awkward : 5 - effortless)	2
If restricted to seated mobility --	
Rate ease of using bath accessories (toilet paper, light controls, etc):	
(1 - impossible to use : 5 - effortless use)	3
Cleaning	
Type of cleaning service (select one) --	
In-house:	☑
Contracted:	☐
Ward cleaning - frequency (per day):	1
Bath cleaning - frequency (per day):	1
Clean before next patient arrival	YES
Rate apparent ward cleanliness:	
(1 - dirty : 5 - immaculate)	2
Rate apparent patient room cleanliness:	
(1 - dirty : 5 - immaculate)	4

D.6 QUANTITATIVE HEALTH INDICATORS DATA

D.6.1 Length of Stay

	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	Averages
Average Age	70	66	70	70	66	69	***68.50***
Average LOS, excluding HITH	6.9	8.1	7.8	8.1	7.6	6.2	***7.45***
Separations	95	76	73	80	82	102	***84.67***

D.6.2 Administered Medication

	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	Averages
Mild Analgesics							
Aspirin Dispersible	224640	316800	316800	374400	374400	***230400***	***306240***
Paracetamol (mg)	1947000	1300000	2387000	1672000	1824500	***1149500***	***1713333.3***
Moderate Analgesics							
Tramadol (mg)	24000	0	39000	9000	45000	***15000***	***22000***
Codeine (mg)	29000	18500	30900	22800	25800	***24800***	***25300***
Potent Analgesics							
Morphine Slow Release (mg)	0	0	360	200	200	***1340***	***350***
Morphine Sulfate (mg)	2200	300	1050	640	600	***750***	***923.33***

D.6.3 Nosocomial Infection

This information could not be obtained from this hospital.

Appendix E: Resource Persons

E.1 DEPARTMENT OF HUMAN SERVICES

Project Liaison: Judith Hemsworth
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Allan Stokes
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E.2 ROYAL MELBOURNE HOSPITAL

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Ward Contact: Rodney Reader
Title – Nurse Unit Manager
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Quantitative Health Indicators Contact – Analgesic Usage: Nicholas Jones
Title – Deputy Director
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Quantitative Health Indicators Contact – Length of Stay: Wendy Tomlinson
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E.3 DANDENONG HOSPITAL

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Administrative Contact 2: Wendy McComas
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Appendix F: Mission and Background of Sponsoring Agency

The Department of Human Services (DHS) of Victoria is a government agency responsible for access to and protection of public healthcare services, and the allocation of necessary resources. Its mission is to "enhance and protect the health and well-being of all Victorians, emphasising vulnerable groups and those most in need" (Capital Management Branch, 2005, p. 2). Through its nine regional offices, the organisation directly employs more than 11,000 people and out sources over 80,000 jobs through hospitals and aged care facilities, ambulance services, and community service agencies. It is composed of eight divisions, all of which have multiple branches (see Figure 68).

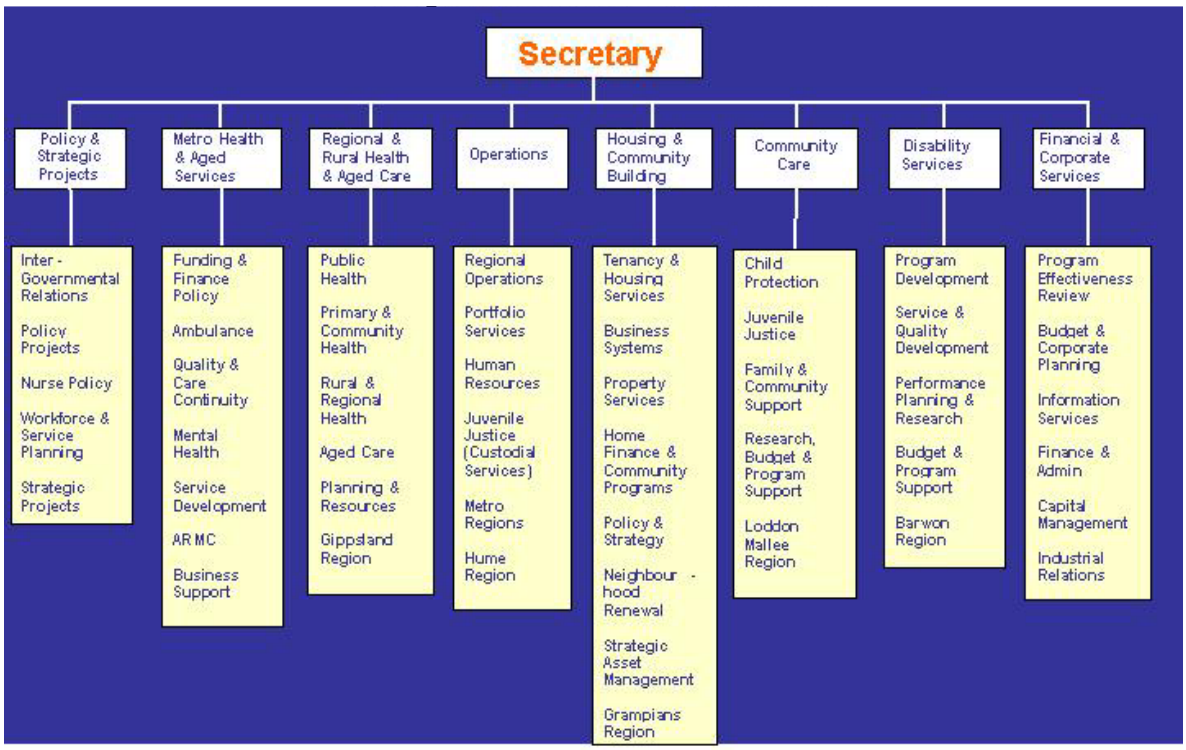

Figure 68: Structure of DHS (Capital Management Branch, 2005, p. 6)

The Capital Management Branch (CMB) exists under the division of Financial and Corporate Services. It is responsible for facilitation of the design and development of healthcare facilities, management of DHS assets, and the acquisition of consulting services and expert architectural advice. The Department is allocated approximately AUD 200 million per year for its Asset Investment Program (AIP), which funds and evaluates the improvements made to both healthcare and community care sectors.