AN INTRODUCTION TO

EVIDENCE BASED DESIGN

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An Introduction to Evidence Based Design

USE OF EVIDENCE BASED DESIGN

For the design of health projects, Hames Sharley utilises an Evidence Based Design approach based on the knowledge acquired from rigorous research conducted around the world aimed specifically at improving the planning and design of health facilities. This approach focuses on the impact that health facility design can make on healthcare recovery rates and therefore provides the link between physical design and operational outcomes.

SO WHAT IS EVIDENCE BASED DESIGN?

The term evidence based design evolved from other disciplines that have used an evidence based model to guide practice in their respective fields. The impetus for evidence-based medicine began in the United Kingdom in 1972. Dr Archie Cochrane, an epidemiologist, was critical of medical practitioners who did not apply research findings in their practice and made clinical decisions based on tradition, what they had been taught (even though it may have been outdated) or incidental anecdotal conversations with colleagues. He espoused the need to use verified research as the basis for clinical decision making.

One of the first formal and widely accepted definitions of evidenced based medicine was put forward by D. L. Sackett and his colleagues in an article they wrote for the British Medical Journal in 1996, where they stated that “Evidence based medicine is the conscientious, explicit and judicious use of current best evidence from research and practice in making decisions about the care of individual patients. The practice of evidence based medicine means integrating clinical expertise with the best available evidence from systematic research”.

Given this background, it is not surprising that health-facilities design has led the adoption of evidence based concepts in architectural practice. A colleague from Texas A&M University, Kirk Hamilton uses Sackett’s definition as a basis, when he defines evidence based design as “a process for the conscientious, explicit and judicious use of current best evidence from research and practice in making critical decisions about the design of each individual and unique project.”

On its website (www.healthdesign.org), the Center for Health Design provides a definition for evidence based design that identifies the purpose, process and outcomes of this approach, as follows:

**PURPOSE** “to create environments that are therapeutic, supportive of family involvement, efficient for staff performance, and restorative for workers under stress”

**PROCESS** “An evidence based designer together with an informed client, makes decisions based on the best information available from research and project evaluations”

**OUTCOMES** “Evidence based healthcare design should result in demonstrated improvements in the organisations clinical outcomes, economic performance, productivity, customer satisfaction and cultural measures”

In summary, evidence based design may be described as the process of integrating the best research evidence, clinical and design experience, and client (including patient, staff, hospital and community representatives) input to guide health-facility planning and design decisions.

Hames Sharley is committed to linking the practice of health facility design with research in this field and to acting as an advocate in promoting the need for research. Our National Director for the Health Portfolio, Warren Kerr AM has “walked the talk” through his active involvement as a Board Member of the Advisory Board for the UNSW Centre for Health Assets Australasia (CHAA), the Advisory Board for the University of WA’s research Centre for the Built Environment & Health, and through his role as the Convenor of the Special Interest Group of the Australasian College of Health Service Management responsible for health facility planning and design, the Australian Institute of Architects Health Architecture Committee in WA and through his role representing Australia on an international work group established under the auspices of the International Union of Architects which meets annually to exchange information on innovations in health facility planning and design.

Through these connections, he is also able to maintain links with similar bodies overseas such as the Medical Architecture Research Unit (MARU) and the Health and Care Infrastructure Research and Innovation Centre (HaCIRIC) in the United Kingdom, the European Health Property Network (EuHPN) and the European Centre for Health Assets & Architecture (ECHAA) in the Netherlands, the Center for Health Systems & Design at Texas A&M University, the Center for Health Design in the USA, the International Academy for Health and Design, etc.
UWA CENTRE FOR THE BUILT ENVIRONMENT & HEALTH

While the focus of CHAA is primarily on health facilities, the research focus of the UWA Centre for the Built Environment & Health is the impact that the built environment has on our lifestyle and health. For example, it researches the impact of suburban layouts on encouraging residents to exercise, the security of neighbourhoods on encouraging children to walk to school and the impact of the urban environment on health indicators and disease outcomes.

RESEARCH INFORMATION DISTRIBUTION SYSTEMS

Because of our passion for improving health facility design, Hames Sharley supports a number of initiatives aimed at ensuring that relevant research is available for those who need it – such as clients who suddenly are appointed to oversee a major health facility project, possibly for the first time in their career.

Knowing the sources of health facility research and disseminating this information is the weakest link at the moment for it relies on a number of dedicated volunteers in professional associations to undertake this important function. However, if it is well-organised, it has the potential to become a very potent force for improving the way we plan and design our health facilities.

Recognising that the planning and design of hospitals and health-facilities is a team effort comprising many different professions and disciplines was the impetus for the Australasian College of Health Service Management setting up a Special Interest Group for this field to take on the role of both distributing the outcomes of the research undertaken and to provide the feedback required.

With the College taking on this coordinating role, it has simplified the task for the research centres. Rather than a University research centre having to interface with numerous practitioners, professional practices or professional associations, the College can perform that interface role and coordinate the responses.

SOURCES OF INFORMATION

This coordination role is a vitally important function. For example, in its second year of operation, the Centre for Health Assets (CHAA) surveyed all the architectural practices it could locate which specialised in health projects, to ascertain which sources of information were used most frequently for the planning and design of hospitals and health-facilities.

The results were staggering.

The survey revealed that the majority of architectural practitioners engaged on health projects used only the information available within their own firms for their background research and design investigations. This information was obtained primarily obtained through site visits, reviewing the firm’s own projects, plus collecting information supplied by clients.

Respondents generally indicated that Health Facility Design Guidelines were viewed as less important and used less often than the firm’s ‘own research’. Reference to published guidelines were only the seventh most frequently used source of information!

Even conferences and seminars were only ranked 8th in importance as a source of information. For those firms who wish to ensure that the results of the latest research are rapidly disseminated to the practitioners responsible for the planning and design of current projects, this is a major challenge.

WEB SITES AND JOURNALS

The other important way in which research results are disseminated is via websites and journals. The websites of the research centres outlined above provide easy access to the guidelines and research undertaken by these organisations.

Another important part of the framework for the systems I referred to earlier, is a dedicated journal addressing research for health-facilities planning and design. Up until 2006, this had always been an aspiration for those working in this sector. However, at the Health Design 07 conference held in Dallas in November 2007, the first journal dedicated to health-facilities research was launched.

HEALTH ENVIRONMENTS RESEARCH AND DESIGN JOURNAL (HERD)

The Health Environments Research and Design Journal (HERD) is an interdisciplinary, peer-reviewed journal whose mission is to enhance the knowledge and practice of evidence-based healthcare design by disseminating research findings, discussing issues and trends, and translating research to practice.

The vision of HERD is to improve healthcare outcomes as a result of enhancing healthcare environments for those receiving and giving care.

HERD is the only one of its kind featuring evidence-based articles for health environments design and outcomes related to organizational performance and the human experience. The commitment to an interdisciplinary design process is reflected in HERD’s interdisciplinary Editorial Board with representatives from healthcare (including nursing, medicine and healthcare administration), the
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design industry (architecture, engineering, interiors, graphics),
environmental and behavioural psychology, neurosciences, systems
and organizational effectiveness, art and music fields, and other
complementary fields.

The journal also centralizes knowledge about healthcare innovations
and designs and addresses significant challenges in the healthcare
industry to improve patient outcomes, to reduce errors and to
enhance the work environments for healthcare professionals.

As a translational journal linking research to practice, HERD features
both rigorous research from academic sources and applied research
from practice. Further details are available from their website
http://www.herdjournal.com

DESIGN AS AN ACTIVE PARTICIPANT IN IMPROVED HEALTH
OUTCOMES

So why is research so important? The primary reason is that over
the last 15 years, research has demonstrated that there is a direct link
between the design of healthcare facilities and the health outcomes
of the patients accommodated within them.

Much of this work has been pioneered by an overseas colleague
who has worked with Hames Sharley on a number of health facility
projects, Prof Roger Ulrich. Roger has demonstrated conclusively
that the recovery rates of patients (and therefore their length of stay
in hospital) are significantly affected by the design of their room.

After conducting research in this field for 15 years, in September
2004, Roger Ulrich and Craig Zimring led a study team for the Center
for Health Design that reviewed several thousand scientific articles
and found more than 600 studies that established how hospital
design can impact clinical outcomes.

The team found scientific studies that documented the impact of a
range of design characteristics, such as single-rooms versus multi-
bed rooms, reduced noise, improved lighting, better ventilation, better
ergonomic designs, supportive workplaces and improved layout that
can help reduce errors, reduce stress, improve sleep, reduce pain
and drugs, and improve other health outcomes.

The team discovered that, not only is there a very large body of
evidence to guide hospital design, but a very strong one. The growing
scientific literature in this field is confirming that the conventional
ways that hospitals are designed often contributes to stress and
impacts on adverse outcomes. However, this research proves that
this level of risk and stress is unnecessary and that with careful
design improved physical settings can become an important tool in

making hospitals safer, better places to work and most importantly
improving clinical outcomes.

The report emanating from this study formed the basis for assessing
the state of the science that links characteristics of the physical
setting to patient and staff outcomes.

Since then, numerous studies have been undertaken linking physical
c Characteristics of the space in which patients are accommodated with
health outcomes.

It has been proven that patients who are less stressed, recover in
the minimum amount of time. In hospital environments, patients are
stressed by noise, other patients, unexpected interruptions and by
not having control of their immediate environment. Stressed patients
often experience higher levels of perceived pain and therefore
may need more pain relief than those who are accommodated in a
relaxing environment.

If patients can be accommodated in a room that is quiet, relaxing
and comfortable, then their recovery rates will be significantly better
than patients who do not sleep well due to interruptions and noise
throughout their stay. While in the past anecdotal feedback led to
these perceptions, through their exhaustive research Roger and
his colleagues have proven the factual basis to these outcomes and
documented the savings that result through reduced length of stay
for those patients whose recovery is assisted in this way.

In his studies, Roger has also demonstrated that an external view
of nature helps patients to relax, reducing their stress levels and
therefore aiding in their recovery. Based on the studies in which
patients were randomly placed in rooms providing the same level of
care, but with either a view of nature (a garden) or of a brick wall as
the only discernable difference, conclusive evidence was compiled
regarding the impact of this outlook on the period required for
recovery and therefore the length of stay of these patients.

Roger and his colleagues were also among the first to compile the
research results on the impact of infections in multi-bed wards,
resulting in the progressive change now underway to increase the
proportion of single bed rooms in new hospital developments. They
demonstrated through research statistics that the cost and risk of the
spread hospital acquired infections was enough to compensate for
the higher capital cost of single bed rooms.

The research team identified at least 16 studies relevant to the
question of whether nosocomial infection rates differ between
single-bed and multi-bed rooms. The findings collectively provide a
strong pattern of evidence indicating that infection rates are usually
lower in single-bed rooms. One clear set of advantages relates to reducing airborne transmission through air quality and ventilation measures such as HEPA filters, negative room pressure to prevent a patient with an aerial-spread infection from infecting others, or maintaining positive pressure to protect an immunocompromised patient from airborne pathogens in nearby rooms. A strong study by Passweg et al. in 1998 found that the combination of room isolation and HEPA filtration reduced infection and mortality in bone marrow transplant patients and significantly increased their one-year survival rates. Research undertaken in 2002 led by A McManus studying burn patients also has shown that single rooms and good air quality substantially reduce infection incidence and reduce mortality.

Severe Acute Respiratory Syndrome (SARS) outbreaks in Asia and Canada a few years ago dramatically highlighted the shortcomings of multibed rooms for controlling or preventing infections both for patients and healthcare workers. SARS is transmitted by droplets that can be airborne over limited areas. Approximately 75 percent of SARS cases in Toronto resulted from exposure in hospital settings. The pervasiveness in Canadian and Asian hospitals of multibed spaces in emergency departments and ICUs, together with the scarcity of isolation rooms with negative pressure, severely hindered treatment and control measures. Toronto hospitals were forced to create additional negative-pressure isolation rooms by quickly constructing wall barriers to replace bed curtains and making airflow and pressure adaptations.

In addition to clear advantages in reducing airborne transmission, several studies show that single-bed rooms also lessen risk of infections acquired by contact. As background for understanding how single rooms can lessen contact spread, it should first be mentioned that many environmental surfaces and features become contaminated near infected patients. Examples of surfaces found to be contaminated frequently via contact with patients and staff include: overbed tables, bed privacy curtains, computer keyboards, infusion pump buttons, door handles, bedside rails, blood pressure cuffs, chairs and other furniture, and countertops.

These and other contaminated surfaces and features act as pathogen reservoirs that increase crossinfection risk. In 1997, Boyce et al. found that in the rooms of patients infected with Methicillin-Resistant Staphylococcus Aureus (MRSA), 27 percent of all environmental surfaces sampled were contaminated with MRSA. Compared to single-bed rooms, multi-bed rooms are far more difficult to decontaminate thoroughly after a patient is discharged, and therefore worsen the problem of multiple surfaces acting as pathogen reservoirs.

Because different staff members who enter a room can touch the same contaminated surfaces, the risk of a nurse unknowingly becoming contaminated is greater in multi-occupancy rooms. Support for this point is provided by research on contamination of nurses in units having patients infected by MRSA. Boyce et al. found that 42 percent of nurses who had no direct contact with an MRSA patient but had touched contaminated surfaces contaminated their gloves with MRSA.

In a study of MRSA infections in NICUs, Jernigan et al. (1996) reported that risk was lowered by isolation in single-bed rooms; high risk was associated with spatial proximity to an infected patient and shared exposure to caregivers. Ben-Abraham et al. (2002) found that nosocomial infection frequency was much lower in a single-bed pediatric intensive care unit than a unit with multi-bed rooms. The investigators tentatively concluded that single-bed rooms helped to limit person-to-person spread of pathogens between paediatric patients.

In summary, there is a convincing pattern of evidence across many studies indicating that single-bed rooms lower nosocomial infection rates. Singles appear to limit person-to-person and person-surface-person spread of infection in part because they are far easier to decontaminate thoroughly than multibed rooms after patients are discharged. Also, single rooms with a conveniently located sink or alcohol-gel dispenser in each room may heighten hand washing compliance compared to multibed rooms with few sinks. Finally, single rooms are clearly superior to multi-bed rooms with respect to reducing airborne transmission of pathogens.

Another innovation resulting from Roger Ulrich’s research in this field is the documented reduction in falls by patients (and all the associated costs attributed to this) achieved by accommodating patients in wards with the ensuite directly adjoining the head of the bed. By installing a hand rail for the short journey to the shower or toilet, the percentage of falls were substantially reduced when compared to patients accommodated in rooms in which the entrance to the ensuite was located in the wall opposite the bed head.

Hames Sharley have been working with Roger Ulrich on the design of the new health facilities applying these principles to the design of the patient rooms.
FUNDING FOR HEALTH-FACILITIES RESEARCH

While the objectives and aspirations of Evidence Based Design are laudable, the research required to enable improved health-facilities to be designed needs to be funded. Unfortunately, at present in Australia funding for health-facilities design research is very sporadic.

Except for the funding provided by the Australasian Health Infrastructure Alliance (the State and Territory Health Departments) for the development of the Australasian Health Facility Guidelines, the only other research funding available is through ad hoc one-off grants to address specific problems or concerns. There is no long-term funding available to specifically address the improvements that could be made in health-facility design.

What is required is a way in which a design dividend could be demonstrated through accessing a regular source of funds for research. Imagine what would be possible, if the budget for the Australian Institute of Sport (or only 0.5% of the annual capital works program for health-facilities) was to be devoted to research in this field. Based on what Hames Sharley has observed overseas, it is apparent that the benefits in reduced operational costs and improved health outcomes would easily justify this expenditure.

FUTURE INITIATIVES TO ENHANCE INNOVATION IN HEALTH- FACILITY PLANNING & DESIGN

Whenever future innovations in health-facility design are discussed at conferences, the participants usually discuss emerging trends in the design of the facilities, without discussing the initiatives which could enable Australia to be assured of being at the forefront of these developments.

Hames Sharley believes that we should be discussing the initiatives that Australia needs to put in place to facilitate innovation in this field in our country.

Hames Sharley is an advocate for developing the systems and research required to support the practitioners responsible for the design of new health-facilities. However, both of these rely on education.

If the practitioners responsible for a major health project don’t have the requisite knowledge, skills and experience going into a project, then the opportunities for innovation are substantially diminished.

So how do the architects, health planners, health-facility planners, engineers, project directors and project managers gain the knowledge required of the healthcare system and hospital departments before undertaking a major health project (or do we allow them to learn on the job)!?

At present in Australia, there is no undergraduate or post graduate course addressing this need. Assuming that those appointed to undertake major health projects are experienced practitioners in their own disciplines, what is required is a process to educate these practitioners in the specific requirements of the healthcare industry.

Some senior members of the Hames Sharley Health Portfolio had the opportunity early in their career to receive specific training in how hospitals functioned by being seconded to work in a variety of health-facilities. Others completed a Masters Degree in health administration and planning at the University of NSW to complement their architectural training in this field. Unfortunately, neither the training program nor this particular Degree program are still available.

However, Hames Sharley are currently trying to re-establish post graduate programs at University level for those interested in gaining the knowledge required for health-facility planning and design.

The concept is to develop a course program for architects, health planners, health-facility planners, engineers, project directors and project managers which they could undertake on a part-time basis by remote learning and through residential schools for 3-4 weeks a year. Although based at one university, this course would be offered throughout Australia and New Zealand. In fact given the burgeoning demand for health-facilities in South-East Asia, it could be offered to overseas students as well.

Hames Sharley has discussed the establishment of these courses with colleagues at Texas A&M University in Texas (who run the largest health-facility design program in the USA) and they have offered their support through student exchange and assistance in course development.

The major hurdle at the moment is to accurately predict the demand for these courses. Because many post graduate programs are run on a cost recovery basis, university’s don’t wish to take on the expense of developing a course of this nature without assurance of the demand.

While all the State and Territory Health Departments have confirmed that there is a shortage of practitioners with the knowledge that would be gained through these programs, this shortage doesn’t necessarily translate into applicants to undertake these programs of study.

One way to do this is to have those who need practitioners with these skills, to fund a scholarship (of approx $10,000) for one or more personnel each year.
SUMMARY

Hames Sharley passionately believes in the importance of research in the field of health-facilities planning and design. However, for innovation based on this research to be implemented, Australia needs a well funded research program together with a well structured process of communication that will enable the results of this research to be quickly and accurately communicated to the design practitioners who have received the specialised training required for the design of our health-facilities.

Through our alliances with research centres in Australia and overseas, Hames Sharley is trying to establish the framework that will realise these aspirations. Hopefully this will provide the basis for healthcare design to lead the way in applying the benefits of Evidence Based Design to architecture in general.

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