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JULY 2009

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Design & Health World Congress review

Academy awards review

Market report: Middle East

Project report: Children's health

Design & Health
International Academy for Design and Health

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Volume 2 Issue 3

Local identity with a global perspective

I was very pleased and honoured to see so many high-quality proposals presented at the 6th Design & Health World Congress in Singapore in June, which was attended by delegates from more than 30 countries. The congress's aim is to recognise professional and research excellence in the field of design and health, and promote a 'salutogenic approach' to healthcare design, changing the focus from risk factors and disease treatment to a more holistic understanding of healthy environments. We need to change the paradigm for designing healthcare environments to one that stimulates our brain and enhances our wellbeing. Psychosocially supportive design stimulates and engages people mentally and socially, supporting an individual's sense of coherence and starting a mental process that attracts our attention, reduces anxiety and promotes positive emotions.

The congress made a valuable contribution to the exchange of knowledge and information, challenging all of us to work with a broader spectrum of professionals. It is only possible to improve and enhance the quality of design, with a view to health promotion, when we take an interdisciplinary approach and critically examine current knowledge.

Topics addressed included the latest research findings on a range of global issues, including design quality standards, evidence-based design/research-based design, mental health, restorative justice, senior care and the health of children and young people. Trends and influences in the Middle East, China, South East Asia, Europe and the US were also considered.

The 2009 Design & Health International Academy Awards, presented at the congress, were enhanced this year to incorporate a wider scope of categories. Supported by a well-structured judging process, the awards perform a vital advocacy role internationally, rewarding and recognising excellence and supporting the benchmarking of design quality.

Thank you to all those who contributed to the event. I would also like to express my deep appreciation to the Singapore Minister for Health, Mr Khaw Boon Wan, for his engagement and for a powerful speech to the congress.

We are now looking forward to the next congress, which will take place in Boston from 29 June-3 July 2011. The US plays a significant role in health, which impacts on the rest of the world: however, although it leads the world in healthcare expenditure, 29 other countries have a higher life expectancy and 38 countries have a lower infant mortality. Obesity is an epidemic, seriously impacting the health of millions of people, especially children. In addition, one-third of all Americans live with a chronic condition. While only 4% of healthcare expenditure is related to preventive care, 25% of healthcare cost is related to administrative work.

Singapore Minister for Health, Mr Khaw Boon Wan and Prof Alan Dilani

The International Academy for Design and Health believes that human health is significantly related to the designed environment, and our mission is to spread awareness of this important message. Using the environment as a strategic tool is one of the most cost-effective and enduring approaches to improving public health, but it is one that requires salutogenic perspectives and a focus on wellness to inspire innovative design solutions.

Design objectives for enhancing human health must facilitate an active lifestyle, enable the successful management of physical, psychological and emotional stress and support mental and cognitive processing of information by stimuli in a variety of designed environments. Central to this cause is the development of a scientific research base, which illustrates and explores the relationship between human health and the environment and, vitally, creates a case for the rigorous application of this knowledge in professional practice.

We would like to invite you to the next congress in Boston, not only to learn from our American colleagues but also to share your knowledge and contribute to the world of design and health in the US.

Prof Alan Dilani, PhD
Director general, International Academy for Design and Health

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Contributors

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AIA national president, Dr Ray Pentecost considers how rising healthcare costs are creating opportunities for designers to engage in health system reform

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Award-winning

In our review (pp14-17) of the 6th Design & Health World Congress in Singapore, Diana Anderson reminds us of the famous words of Oliver Wendel Holmes, who said: "Many ideas grow better when transplanted into another mind than in the one where they sprang up."

The pertinence of this quote to the success of Singapore will be self-evident for those who attended this extraordinary global forum of researchers and practitioners, even though we may never know the extent of the impact that the sharing of knowledge will have on the design of healthy environments.

The creation of such a rich source of data, information and knowledge from the congress presentations was supplemented this year by the Design & Health International Academy Awards (pp21-33). The value of a credible awards programme extends further than reward and recognition, although this is of course important. As John Zeisel points out in his comment (p55) on Charles Cadenhead's study of award-winning critical care units (72-76), the data generated from award entries is often overlooked and more attention should be given to how it can support research and benefit evidence-based design, as well as enable benchmarking and standards development. When we see you at the 7th Design & Health World Congress in Boston in 2011, what price the knowledge created from two more years of award entries.

Marc Sansom
Editorial director

Contents

Editorial Director
Marc Sansom MBA
T: +44 (0) 1277 634 176
E: marc@designandhealth.com

President
Per Gunnar Svensson PhD

Director General
Alan Dilani PhD
T: +46 70 453 90 70
E: dilani@designandhealth.com

Editorial Advisory Board:
Joint Chairmen
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Dr Linda Jones, PhD New Zealand
Dr Eve Edelstein, PhD, US

Subscriptions and advertising
T: +44 (0) 1277 634 176
E: WHD@designandhealth.com

Published by:
The International Academy for Design and Health
PO Box 7196, 103 88 Stockholm, Sweden
T: +46 70 453 90 70
F: +46 8 745 00 02
E: academy@designandhealth.com
www.designandhealth.com

International Academy for Design and Health UK
8 Weir Wynd, Billericay
Essex CM12 9QG UK
T: +44 (0) 1277 634 176
F: +44 (0) 1277 634 041
E: WHD@designandhealth.com

Design and production:
Graphic Evidence Ltd
Wood Farm, Moreton Road
Ongar, Essex CM5 0EY UK
T: +44 (0) 1277 890 900
E: info@graphic-evidence.co.uk
www.graphic-evidence.co.uk

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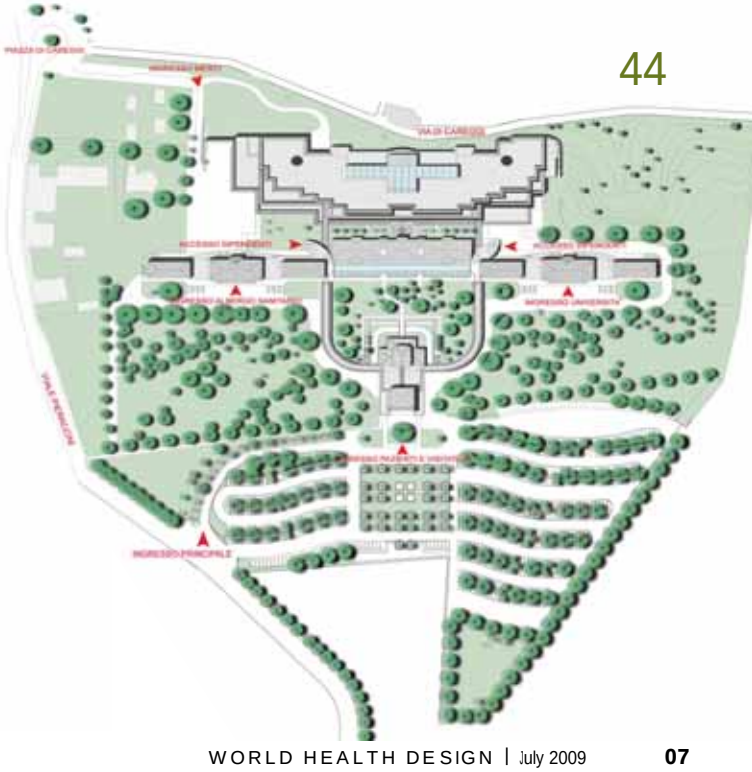


Briefing

Global gathering in Singapore

Almost 400 researchers and practitioners from 30 different countries came together in Singapore last month to hear world experts present leading edge research papers and case studies of benchmark healthcare facilities at the 6th Design & Health World Congress

Held at the Ritz Carlton Millenia, the congress is the foremost event in the world promoting interdisciplinary research and practice in the development of healthcare environments. Despite the impact of the global economic recession and fears over the spread of the H1N1 virus, delegate numbers improved by 20% on previous congresses, as they heard global figures from the healthcare sector, such as Singapore Minister for Health, Mr Khaw Boon Wan and Lord Nigel Crisp, former chief executive of the NHS speak about the role of design and architecture in shaping global health systems.

The congress also hosted this year's Design & Health International Academy Awards, which recognised and rewarded winning projects from Australia, Italy, Finland, Canada, the US and the UK in a prestigious ceremony and gala dinner on the final evening of the event.

For a review of the congress, see pp 12-17. For the award finalists and winners, see pp 21-33

Packed audiences filling the Grand Ballroom at the Ritz Carlton, Singapore

Iraq: Taking the lead

MJ Medical and a Lebanese partner have been selected as the lead design consultants for an Australian-led consortium designing, building and equipping three state-of-the-art hospital facilities in Baghdad, Diyala and Diwaniya in Iraq.

UK: Milestone reached

The £335m Greater Peterborough Health Investment Plan, designed by healthcare architects Nightingale Associates and Tribal healthcare planners, has reached a major milestone with the completion of its City Care Centre and Cavell Centre (mental health unit).

USA: High-tech design

Construction is complete on the new 385,000 ft^2 West Chester Medical Center in West Chester, Ohio. The $116 million acute care hospital and medical office building complex was designed by RTKL using high-tech and evidence-based design tools to support advanced, patient-centered care.

UK: Patients occupy Springfield

The £23m Wandsworth Acute Unit at Springfield's University Hospital for South West London and St George's Mental Health Trust is now occupied. Designed by MAAP Architects, the facility includes a 18 bedded acute ward (AAU) and a 10 bedded psychiatric intensive care unit (PICU).

USA: Top of the tree

For the second consecutive year, HOK ranks as the greenest design firm on the planet. A new survey published in the July 6, 2009, issue of Engineering News-Record (ENR) magazine ranked the global architectural design practice as the firm engaged in the most sustainable work.

USA: Recycling innovation

Clinics to Containers (C2C) is a non-profit initiative that converts industrial shipping containers into rural health clinics, making use of the 25 million discarded shipping containers in the world's ports. Anshen+Allen will design C2C's pilot project planned for deployment in Central America in 2010.

UAE: Zeidler opens in Middle East

Zeidler Partnership Architects has opened a new office in Abu Dhabi, United Arab Emirates. Zeidler, has successfully completed projects in Dubai with developers, such as Emaar in recent years and has ongoing projects in Abu Dhabi, Saudi Arabia, Qatar and Yemen.

USA: Hitting the heights

Parkland Memorial Hospital has again been named one of "America's Best Hospitals" by US News & World Report. Rankings are based on reputation, death rate, patient safety and care-related factors such as nursing and patient services.

Australia: Going down under

Founder of the International Academy for Design & Health, Prof Alan Dilani has been appointed as a visiting professor at the University of New South Wales Injury Risk Management Research Centre in the Faculty of Science, in Australia.

UK: Socially sustainable

The 65,000m^2 New Acute Hospital for the South West in Enniskillen has reached Financial Close. Designed by Anshen + Allen, the £270 million scheme is located on a beautiful rural site in Co Fermanagh, set amidst wooded hills, meadows and lakes, representing a genuine integration of building and landscape in an environmentally and socially sustainable design.

India: 15 new hospitals

International Finance Corp (IPC), a member of the World Bank group, will provide $50 million as a loan to Indian private healthcare provider, Apollo Hospitals for investing in 15 new hospitals across India in the next three years. The investment will focus on providing high quality services to smaller cities. across the country.

Australia: Global accolade

Global architectural firm Woods Bagot, has been recognised as the 'International Practice of the Year' at the prestigious AJ100 Awards in London.

World Congress heads to Boston, USA in 2011

News that the 7th Design and Health World Congress & Exhibition will be held in Boston in 2011, is exciting researchers and practitioners in the US and across the world

Firmly established as the leading global forum promoting the exchange of knowledge and research in the field, following the huge success of the 6th Design & Health World Congress in Singapore last month, the International Academy for Design & Health has already begun preparations for the next World Congress in the city of Boston, USA.

The USA spends twice as much as other industrialised nations on healthcare, yet its system arguably performs poorly by comparison, leaving more than 45.7 million people without health coverage, whilst 29 other countries achieve a higher life expectancy and 38 other countries have lower infant mortality.

Design & Health founder Prof Alan Dilani said: "As healthcare costs in the western world continue to rise, the impact of the global economic downturn has forced governments and public institutions to face up to a new economic reality that is demanding investment in sustainable social architecture and the design of healthy environments that improve human wellbeing and quality of life.

Boston Harbor Skyline: The view of downtown Boston from across the harbor in Charlestown

"The opportunity to organise the congress in Boston will provide a platform in the USA, which remains a benchmark for the world, to engage at this important time of change for health systems, which across the world are faced with the challenge of ever rising costs and demand."

The International Academy for Design and Health believes that human health is significantly related to the designed environment. Its mission is to spread awareness through its education, research, events, media and advocacy work of this important message and to improve and underpin future professional practice in health promotion by design.

Prof Dilani added: "The design and architecture of health services, technologies and buildings play a critical role in reshaping health systems which require a far greater focus on preventative medicine and care than current systems.

"Using the environment as a strategic tool is one of the most cost effective and enduring approaches to improving public health, but it is one that requires salutogenic perspectives that consider wellness factors to inspire innovative design solutions."

The Call for Papers for the World Congress in Boston will be published in October. Papers that address more than one topic related to health promotion by design and its economic impact will be given preferential attention. All papers are subjected to blind review.

Marc Sansom, marketing and communications director, said: "Discussions are already underway with potential partners, sponsors and exhibitors, and we are open to opportunities to work with new and old friends from around the globe towards the success of the Boston congress."

For more information, contact either Prof Alan Dilani at dilani@designandhealth.com or Marc Sansom at marc@designandhealth.com

Time for change in mental health

Building high-quality mental health facilities is not just about money, but vision and joined-up thinking, experts told delegates at a Building Better Healthcare conference last month, writes Jo Makosinski.

John Cooper

Organised in partnership with the International Academy for Design & Health, Enhancing Mental Health Environments 2009 aimed to identify how investment in the design and development of improved facilities could contribute to the more effective delivery of services.

Highlighting the importance of user involvement, careful planning and collaboration between providers, commissioners and design and construction teams, speakers at the event in central London were united in their desire to change the face of healthcare for mentally ill patients.

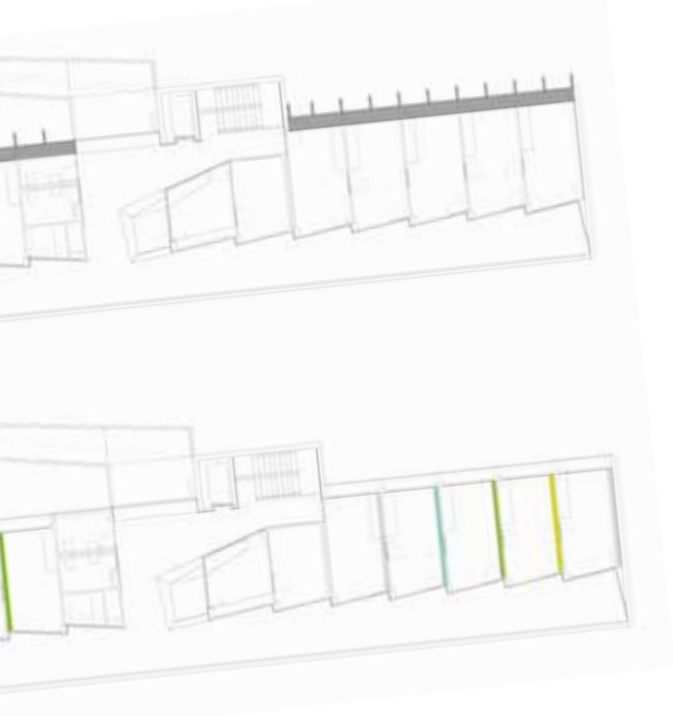
Chairing the day, John Cooper of Architects for Health told delegates there was a real need for modernisation of the mental healthcare estate, but added that it was important to avoid quick fixes and instead spend time finding the ideal solution that would work in practice.

He said: "A significant proportion of mental health accommodation is still provided in buildings dating back to the 1940s or earlier. That's a daunting figure when you could argue that such outdated buildings are no longer fit for purpose.

"At the same time as the estate is failing, we are seeing a large rise in admissions and a shift to a new regime of facilities based on crisis resolution. We are redefining how mental health units are provided and that's a good thing, but nonetheless many wards are still uninhabitable and failing the very people they were built to support."

For the full story, visit www.worldhealthdesign.com

Small but perfectly formed



Tenerife's Ravelo Medical Clinic, designed by gpy arquitectos, was the recent winner of the Design & Health International Academy Awards Judges' Special Prize. The award is given to a project submitted across any category that is particularly recognised for its salutogenic qualities.

The outpatient clinic, which serves a small rural community, has been designed on two levels, both with street-level pedestrian access. The main floor is occupied by the medical surgeries for general medicine and paediatrics, as well as the nurses' station and the administrative areas. The lower floor houses a small 24-hour accident and emergency service as well as multipurpose spaces for community activities and a staff area.

The clinic is used for various community services, and so it also fulfills a social function. Its main entrance has been adapted to accommodate the steep slope of the street, and makes the public space extend right into the building. This sense of openness continues with the inclusion of a large panoramic window adjoining the waiting room.

On the upper level, the medical surgeries are south-facing; the design of their façade generates an intermediate space between the interior windows and exterior folding shutters, which regulates the entry of sunlight. It is this feature that lends the building its bioclimatic character, while at the same time offering optimal lighting conditions for the workspaces. In these rooms,

Ravelo Medical Clinic, Spain

Location: Calle Hoya de la Viuda, Ravelo, Tenerife
Client: Canary Islands Government and the Canarian Healthcare Service
Architect: gpy arquitectos
Site area: 1,106 m^2
Floor area: 706 m^2

the natural light entering the building is filtered and reflected on coloured surfaces to create a comfortable, warm atmosphere.

A continuous internal wooden skin separates areas for specific medical uses from public areas such as the waiting room, stairway, corridors and reception area, and creates a contact surface which organises the routes through the building. There is a dialogue between this timber interior, which transforms the framed empty space into a series of rooms, and the external concrete frame, open along the north-south axis, which gives the building a more urban feel.

The clinic, which has been built on a steep hillside, is an intuitive and scaled response to its surrounding landscape. To the north, the concrete frame of the building faces the distant countryside, and the view from its panoramic window converts the public waiting area into a therapeutic space that is directly connected with the landscape. The judges of the awards said of the project: "Although this building only serves a small rural community, it has a mature and authoritative presence. Its clear-cut definition adds distinctively to the uniqueness of its setting."

For the full list of award winners, see pp 21-33

Efraín Pintos

Shaping the future

It's not just better design; it's the chance to shape a nation's health, writes *Dr Ray Pentecost*. Economic turmoil and rising healthcare costs are creating new opportunities for healthcare planners and architects

Healthcare planning and design communities worldwide are experiencing unprecedented opportunity to expand their influence beyond the confines of the built environment and into the policy realm where national priorities, agendas and strategies are shaped. Why? Because the professionals who plan and design healthcare facilities are creating operating efficiencies and savings on a scale that can be used to underwrite new and/or expanded healthcare programming, and health system leaders with shrinking resources are taking notice.

Healthcare design research is yielding opportunities for the design community to impact areas of high cost in healthcare delivery, such as nosocomial infections, slips, trips and falls, and medical errors. It is also suggesting ways that design might impact staff safety, performance, satisfaction, and retention in competitive, global labour markets. In the US, for example, the financial impact of staff shortages are costing billions of dollars, yet it is still unclear how to incorporate these priorities into national health agendas.

Singapore, the host city for last month's 6th World Congress on Design and Health, proudly demonstrated to the world at this important global forum its well-organised healthcare system. First, the focus of the health leadership in Singapore is on the health of every citizen. It is not on a medical transaction, which sometimes comes with a diminished concern about personal health and wellness, as is often the case in a supply-driven healthcare system.

Second, the creation of savings and efficiencies are harvested by those capable of redeploying them, the central health ministry. Sadly, in fragmented healthcare delivery systems the savings are often created by those who are not empowered to re-use them. Third, system overseers are committed to setting realistic limits on what is spent on the health of their nation. Financial gateways of personal accountability discourage the inappropriate and excessive utilisation of resources.

Perhaps the greatest challenge for health planners in decentralised systems is that if one doesn't control, or at least strongly influence, the direction of the health system, like in Singapore, then realistically one is only able to choose two of the three points on the triangle in Figure 1. Having chosen two, the third becomes a derivative of those choices. However, if planners are able to shape the healthcare system, or at least articulate a clear and compelling national agenda, then the potential exists to address all three points and tailor the system to support them.

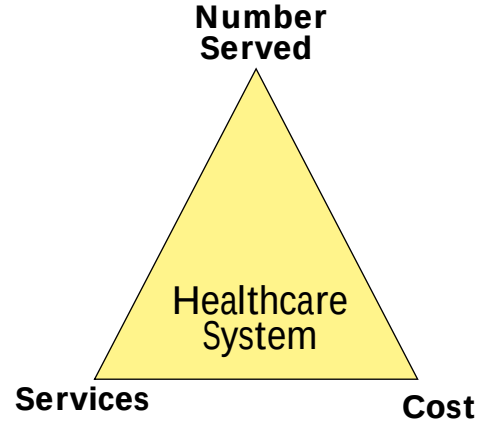


Figure 1: Focusing the Healthcare System

So how does this translate into an opportunity for the planning and design communities to sit at the table of healthcare system policy, strategy and design? There are at least two ways. First, to create new programmes that emphasise health promotion or wellness, or to extend services to those unable to afford them, resources must be found. Design research that could shape healthcare facilities capable of saving billions annually in operating costs and favourably impacting healthcare staffing needs to be understood, appreciated and strongly underwritten nationally. It could unlock significant, enabling resources.

Second, planners and designers must introduce a greater emphasis on salutogenic design, or design that supports healthy behaviour. Not only do these designs improve personal health, they should reduce the demand on other resources in the healthcare system at large. In one Singapore hospital signs encouraged workers to use the stairs, not take elevators, because it was good for their health. Successful salutogenic design must be driven by rigorous research.

The WCDH 2011 will be held in Boston, Massachusetts in the US, and the focus will be on ways in which the planning and design communities can engage in and help shape the national health policy debate. Focus on the health of the individual should direct the agenda. Research must empower the strategy. Results will get us an invitation to the next debate. See you in Boston!

Dr Ray Pentecost III, DrPH,AIA,ACHA, LEED AP is director of healthcare architecture for Clark Nexsen Architecture & Engineering and the 2009 national president of the American Institute of Architects – Academy of Architecture for Health

Local identity, global perspective

The four-day 6th Design & Health World Congress & Exhibition in Singapore was a resounding success, spreading knowledge and fostering dialogue between researchers and practitioners in the interdisciplinary field of healthcare design. *Diana Anderson* and *Marc Sansom* report

Singapore Minister for Health, Mr Khaw Boon Wan

Perhaps the UK's Lord Nigel Crisp said it best at the start of his congress presentation on Global Health Partnerships: "and we meet again in wonderful Singapore, where the old meets the new and where East meets West."

The image of this intersection between history and culture is a fitting description, both for the island of Singapore where the event took place, and as a depiction of the uniquely global character of the Design & Health community.

The gathering of almost 400 delegates, including architects, designers, health administrators, economists, psychologists, clinicians, nurses, health scientists and government officials from more than 30 countries, to exchange research, design solutions, stimulate discussion for new ideas and find and create business opportunities, demonstrated clearly how healthcare must now be considered within a global context.

Global interdependence

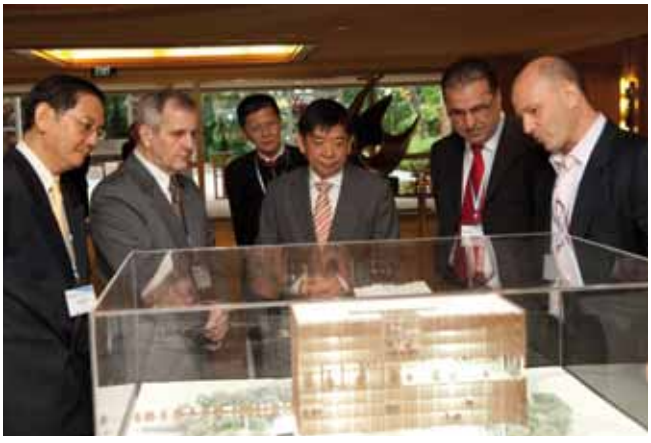
Against the backdrop of rising fears over the threat of the H1N1 virus in a part of the world that has not yet forgotten the social and economic impact of SARS, our global interdependence was a lesson that remained vivid to delegates in every conversation and meeting they had, and every presentation they listened to.

It was a message that also struck home during the Singapore's Minister for Health, Mr Khaw Boon Wan, opening speech. In an impressive demonstration of knowledge of the past fifty years of progress in healthcare within Singapore, Khaw Wan Boon, described the country's achievements in developing one of the most efficient and effective health systems in the world, whilst looking forward to the future and the health and design challenges of ageing populations, technological advances, and infectious disease spread by every nation.

Lord Crisp, who without the use of slides, discussed how our global interdependence had created the conditions for greater collaboration between the developed and the developing world, reinforced the need for a global perspective on these modern 21st century issues. "Increasing globalisation has allowed for the greater sharing of knowledge and experience, but has allowed diseases to travel, whilst the health impacts of climate change will be damaging for us all," he said, arguing that there are new opportunities for, "learning together how to operate efficiently and effectively within an environment where resources, carbon-based and financial, are in increasingly short supply."

The important notion that design and health also reinforce each other was presented through a series of 12 sessions over three days, each session featuring 3-4 speakers followed by a question and answer period. Themes of the sessions included such topics as: New Paradigms in Design and Health; Health and Healthcare Design

in Singapore, China, Korea and the Middle East; Humanistic Architectural Responses in Health Design; Design and Health Impacts on Patients, Staff and Visitors; Cultural Perspectives and Global Health Partnerships; Improving Organizational Image and Performance; Designing Environments for Children and Senior Care; and Designing Institutional Environments that Care.



Matthew Saunders of Broadway Malyan demonstrates Singapore's new National Heart Centre design to Minister for Health, Mr Khaw Wan Boon (centre) and (from left), Liak Teng Lit, Alexandra Health; Steven Sobak, SingHealth; John Ting, Singapore Institute of Architects past president; and Prof Alan Dilani.

New generation

Across the world, investment in healthcare infrastructure is a major priority for governments over the next 10-15 years and it is no exception in Singapore. In the morning session on the first day, which focused largely on Singapore's own approach to healthcare delivery, Liak Teng Lit, chief executive officer of Alexandra Health and Ruby Lai, senior consultant at CPG Consultants, explained how new projects will have a different emphasis from the hospitals constructed in the previous decade. "Greater focus would be placed on ensuring hospitals were patient centric – friendly and welcoming. The hospitals will be designed with flexibility in mind to cater for rapid changes in medical treatment. Greater emphasis will also be placed on thermal comfort, energy efficiency and conservation of resources," they said.

Incorporating many of these key features, the new Khoo Teck Puat Hospital, visited by many of the delegates on the study tours, was described by Liak Teng Lit as the first of a new generation of hospitals, that will set a new benchmark for healthcare design, not only in Singapore and Asia, but potentially the rest of the world.

The theme of how a shift in emphasis towards a greater understanding of salutogenic health and how the environment can be used as a tool for preventative medicine as a means of promoting and supporting health processes, was common throughout the sessions.

Above: Delegates from 30 different countries filled the Grand Ballroom at the Ritz Carlton Millenia every day
Below: Meeting of minds: (from left) Tye Farrow, Farrow Partnership Architects; Dr Eve Edelstein, San Diego Academy of Neuroscience for Architecture; and Bill Rostenberg, Anshen + Allen

One of the highlights for many delegates was the approach taken by Tye Farrow of Farrow Partnership Architects, who in his paper, 'Bringing Hospitals to Life: Design Quality Standards', drew on the research of Harvard biologist, E O Wilson, who suggested that an innate human desire for close contact with the natural world occurs on a physical, emotional and intellectual level. By identifying international benchmarks, Farrow called for design standards to be anchored in biophilia research and the need to work with the power of nature and not against it.

Farrow's ideas were reinforced by Kristen Whittle's description of the design of the new Royal Melbourne Children's Hospital, which was inspired by the surrounding parkland setting of Royal Melbourne Park. Said Whittle: "The 'park in the building' concept has influenced every aspect of the hospital planning and has been carried through into the material expression of the building, by using the natural textures, forms and colours of the park."

Architecture of incarceration

The emphasis of how health and design relate to the wider social, cultural and political context was expressed through several sessions, most notably by the discussions on the architecture of incarceration. Here, Lord Crisp returned with Chris Liddle of HLM Architects, to present a paper on how to create custodial facilities where a combination of dignity and care, education, community and overall environment contribute to the ultimate goal of rehabilitation in society and the prevention of reoffending. Posing as client and architect respectively, together they challenged the audience to seek out new perspectives on health promotion from a wider societal point of view, calling for greater research into the designs that promote

Left: The Olympus exhibition booth where delegates could be found discussing the future of operating room design
Right: Session chair, Dr Ray Pentecost takes questions from the audience for John Steven, Stantec, Tye Farrow, Farrow Partnership Architects and Ashikur Rahman Joarder, Health and Care Infrastructure Research and Innovation Centre (HACIRIC)

prisoner health and the use of prisoner reference groups.

This reinforcement of design and health as a larger social issue which reaches beyond the realms of science and technology was a recurring theme during the congress, emphasising the fact that health, social, cultural and political issues are deeply intertwined.

In the words of Oliver Wendel Holmes: "Many ideas grow better when transplanted into another mind than in the one where they sprang up." With a major investment in the healthcare built environment currently underway worldwide, never before has it been so necessary to develop new evidence-based research and design solutions. The notion of flexibility in design and the adaptation of existing health buildings are no doubt as important as the challenge of developing new facilities. By coming together and sharing interdisciplinary ideas and viewpoints through this type of congress, the opportunity to solve these existing and future challenges through a shared vision becomes much more achievable.

Copies of the presentations from the 6th World Congress event in Singapore are available at www.designandhealth.com and www.worldhealthdesign.com

Showcases

During the lunchtime period each day, the Design & Health 'Sponsored Showcases', provided a more informal environment for discussion on key topics, such as: the operating room of the future; achieving design quality in PPP (Public Private Partnership); good preparation and briefing in building design; and the experience of lighting in the hospital of tomorrow. Here, Craig Dixon of Tribal describes to healthcare practitioners how good preparation and briefing leads to stronger engagement and subsequently, better facility design. In addition, over 20 posters were displayed on a wide scope of topics within the main gathering space for the congress, where delegates could examine the research and projects at their own pace, while also generating discussion over the topics displayed with others.

Diana Anderson, MD, MArch is an architect with WHR Architects

Marc Sansom MBA is the editorial director of World Health Design

The 7th World Congress & Exhibition will be held in two years' time from 29 June-3 July in Boston, Massachusetts, USA. The Call for Papers will be published in October 2009. For more information, visit www.designandhealth.com or contact Prof Alan Dilani at dilani@designandhealth.com or Marc Sansom at marc@designandhealth.com

A dose of dialogue

With the vibrant Singapore cityscape as its backdrop, old colleagues reconnected and new friendships forged at the 6th Design & Health World Congress & Exhibition. Here, three participants reflect on the knowledge they gained, and look forward to the themes that may emerge at the 7th World Congress in Boston in 2011

The media coverage of the H1N1 flu pandemic during the congress highlighted how our health and wellbeing are increasingly connected globally, reinforcing the value and relevance of this important international forum.

This year's congress was particularly outstanding in its rich and diverse program of presentations; the seamless organisation of events; and the well-structured process for the Academy Awards recognition.

The 'grey tsunami' will be a major contributor to the cost of care provision

For all participants, the international knowledge exchange was enriched by the full spectrum of topics ranging from the very current and pertinent debate on the PFI/PPP procurement process to the fascinating examination of operating room clothing.

There was stimulating discourse between the continuing research focus of evidence-based design and experience based observations. The greatest challenge of all, however, will be to ensure that the hospital administrators and financial stewards are also champions for design excellence.

The need for greater global health partnership was echoed by the recognition for cultural sensitivities as we work with the developing countries in the world. One example discussed – a hospital in Malaysia where patients and families in the waiting areas were seated on rugs – highlighted the need for us to examine our common notion of waiting rooms.

One resounding message presented by many is the fast approaching global 'grey tsunami'. There is a sense of urgency in addressing this phenomenon, as it will be the major contributor to the cost of care provision for our growing elderly population.

As we strive to create the best, healthiest environment in which to live, work and receive care, in a world of diminishing resources, the Design & Health continues to provide an inspiring platform for the sharing of valuable knowledge and experience.

Alice Liang, principal, Montgomery Sisam

This year's congress in Singapore was a resounding success. Through the scientific papers presented, the Design & Health International Academy Awards, study tours, exhibit and poster presentations, it addressed the broad and rapidly changing context of the trends and issues facing global healthcare design today.

Looking forward to the 7th Design & Health World Congress in Boston in 2011 the US will by this time have hopefully enacted significant legislation for a Universal Insurance Program. Perhaps in 2011 we can also pay more attention to the basic guiding principles of quality, access and cost, which will no doubt be major considerations in any universal health legislative program in the US, as well as an objective for the population of the planet as a whole.

It is critical that we address the broader health issues facing our finite planet

It is critical for the success of 2011 that we address the broader complex health issues facing our finite planet as a whole, including poverty, air and water quality, nutrition, habitat, environmental health issues, renewable energy sources, communication and education, economic opportunity, sustainable development, healthy cities, transportation and an ageing population.

We cannot (and must not be perceived as wanting to) add more and more expensive health facilities that are financially inaccessible to the vast majority of the earth's growing population, and financially impossible to operate. It is also critical to delve further into the complex issues of health in the developing countries of the world, recognise an interdependence with the developed world, and encourage their participation in Boston 2011.

George J Mann AIA, The Skaggs-Sprague Endowed Chair of Health Facilities Design Texas A&M University and Founder and Chairman The RPD (Resource Planning and Development) Group

As a first timer, this year's congress exposed me to an immense wealth of information on the need to base better hospital planning on evidence-based design analysis.

The spirit of sharing the information for the sole purpose of building better healthcare facilities for future generations is highly valuable. The concept of ICUs built by taking care of the influence of the environment to facilitate recuperation, for example, offered an alternative perspective to the current concept that ICUs should be isolated with no windows for patients and staff to enjoy the outside world.

Having said that, I believe that more medical planners from the medical profession should attend this event alongside the building architects and engineers. It will mean that more inputs can be shared and more ideas generated for the betterment of the concept of healthcare in this century.

I also learnt that healthcare design is a living movement. The size of operating theatres, wards and rooms evolve with time, based on facilities, high-tech equipment and types of procedures. Arts, creativity and community participation also has a great influence on the course of patients' recovery. The wellbeing of patients and staff mood is influenced by the environment and of the caring attitude of the caregivers.

The significant attention paid to health economics, which is as a key component of any healthcare service and design philosophy, also ensured the congress offered a complete course of continuous professional development to many of us who attended.

Dr Abd Rahim Mohamad MBChB(Alex), MScPH(S'pore), MPH(Boston), director, Planning & Development Division, Ministry of Health Malaysia

Setting global benchmarks

The Design & Health International Academy Awards recognises professional excellence in the research and practice of designing healthy built environments. This special report profiles the winners announced in Singapore in June

By setting standards and benchmarks, the Design & Health awards progamme has a significant influence on the global design and development of humanistic environments that support health, wellbeing and quality of life. Comprising six categories across the key areas of international healthcare delivery, the awards were presented in Singapore during the 6th World Congress for Design & Health at a prestigious ceremony at the Ritz Carlton Millenia.

The six categories were:

- International Health Project (over 40,000m^2)
- International Health Project (under 40,000m^2)
- Mental Health Design
- Elderly Care/End of Life Care Design
- Product Design for Healthcare Application
- International Research Project

Exemplar projects

Reflecting important aspects of the exceptional work undertaken by researchers and practitioners at the forefront of the field, the recipients of this year's awards are those who, through unique and outstanding efforts, have contributed to the progress of knowledge, and demonstrated vision and leadership in exemplary initiatives and projects.

Open to international organisations and individuals in both the private and public sectors participating in either research or practice, including the planning, procurement, design, construction and management of healthy built environments, only completed built projects or research programmes completed between 1 February 2007 and 31 January 2009 were eligible to enter.

The awards were co-chaired by John Wells-Thorpe – writer, architect, historian and an international advisor to Design & Health – and Prof Per Gunnar Svensson, president of Design & Health, who approved the recommendations of the lead judges and their panels in each award category.

Judging process

Constructed from a group of independent experts from Europe, Asia, Africa, Oceania and the Americas, the judging panel comprised experts in their field from multidisciplinary backgrounds, bringing with them a breadth of experience in the field.

While each award category had its own criteria, the judges were also asked to consider the following key aspects of any built project: concept; fitness for purpose; originality; application of research findings; benefit to the community; life cycle costs; client satisfaction; value for money; building performance; procurement; and the quality of design and construction.

John Wells-Thorpe

The academy's director general, Prof Alan Dilani said: "We are grateful to all our judges for their critical contribution to this year's outstanding awards programme, and offer our congratulations to all the finalists and winners for their exemplar work."

Please turn to the following pages to view the criteria, finalists and winners for each award category.

The academy's director-general Prof Alan Dilani introduces the awards in Singapore

International Research Project

Lead judge

Dr Paul Barach
Professor of Safety Science and Anesthesiology, University of New South Wales, Australia

Panel

Dr Eve A Edelstein, MArch, PhD (neuroscience), Assoc AIA., F-AAA, Visiting Scholar, University of California, San Diego, New School of Architecture & Design, San Diego Academy of Neuroscience for Architecture
Mungo Smith, director, MAAP Architects

Sponsored by
MAAP Architects

Criteria

Awarded for a completed, independently assessed, piece of research focused on a particular aspect of the design, function, construction, financing or maintenance of a healthcare facility or addressing a relevant topic concerning public health in the context of the working environment.

Winner

Inpatient Unit Flexibility: Design Characteristics of a Successful Flexible Unit. Dr Debajyoh Pati BArch, MASA, PhD, FAIA; HKS, US; Tom Harvey MArch, MPH, AIA, FACHA, LEED AP; HKS

The judges said: "Awarded for overall scientific rigor, innovativeness, impact on field, clarity of writing and ability to raise the tenor of the discourse around this key topic. Inpatient unit flexibility is a important topic in Europe and Australasia and to a certain extent in the USA."

For the full paper, see pp56-63

Paul Hyett (right) receiving the award on behalf of Dr Pati of HKS, from panel judges Dr Eve Edelstein (left) and Mungo Smith (middle)

Highly Commended

Determining an Environmental Audit tool for Dementia Specific Research. Ian Forbes, Director Health, DesignInc Architects and Adjunct Professor, Faculty of Design Architecture and Building, University of Technology, Sydney. Richard Fleming, Director, Dementia Services Development Centre, HammondCare and Clinical Associate Professor, Faculty of Health and Behavioral Sciences University of Wollongong

The judges said: "This paper, which evaluates the validity of a new survey method by comparing it to an existing accepted survey method, is unique among the submissions this year. It demonstrates how the scientific analytic method can be used to explore design-related questions."

For the full paper, see pp65-71

International Healthcare Project (over 40,000m²)

Lead judge

Prof Per Gunnar Svensson
President, International Academy for Design and Health

Criteria

An award for an outstanding acute or non-acute healthcare building where patient-centred considerations are as evident as clinical and managerial priorities.The project must demonstrate an understanding of the therapeutic effect of a 'healing' environment, and show how innovative design permits ongoing flexibility of use, addresses issues of sustainability and has an elevational treatment that recognises the broader civic context.

The finalists

Banner Gateway Medical Centre (USA), NBBJ
Royal Women's Hospital (Australia), Design Inc Melbourne + Woodhead
Harold Alford Centre for Cancer Care (USA), Tro Jung Brannen and SMRT
American British Cowdray Women's and Children's Hospital (Mexico), HKS
St Helen's Hospital (UK), Capita Architecture
Peterborough Regional Health Centre (Canada), Stantec Architecture
St Francis Children's Hospital (USA),Tro Jung Brannen
Los Angeles County & University of Southern Medical Centre (USA), Hellmuth, Obata + Kassabaum (HOK)
Samsung Cancer Centre (Korea), Ellerbe Becket
Queens Hospital (UK), Jonathan Bailey

Sponsored by
CPG Consultants

Highly Commended

American-British Cowdray Women's and Children's Hospital, Mexico
Commissioned by American British Cowdray Medical Centre
Designed by HKS, Inc

The judges said: "A clearly articulated design emphasising the distinctiveness of its functional parts within strict environmental and amenity parameters."

Peterborough Regional Health Centre, Canada
Commissioned by Peterborough Regional Health Centre
Designed by Stantec Architecture

The judges said: "The clarity of the cross-axis circulation produces a confident solution, enhanced by the careful use of locally sourced and familiar materials."

Winner

Royal Women's Hospital Melbourne, Australia
Commissioned by Royal Women's Hospital
Designed by DWI - DesignInc Melbourne + Woodhead (Architects in Association)

The judges said: "A convincing design which reflects the latest clinical and management thinking in this specialised area whilst enhancing patient sensibilities."

The winning team from DesignInc Melbourne + Woodhead (Architects in Association) receive the award

International Healthcare Project (under 40,000m²)

Lead judge
John Ting
Past President, Singapore Institute of Architects

Panel
Paul Hyett, HKS
Tye Farrow, Farrow Partnership Architects

Criteria
An outstanding acute or non-acute healthcare building where patient-centred considerations are as evident as clinical and managerial priorities. The project must demonstrate an understanding of the therapeutic effect of a 'healing' environment, and show how innovative design permits flexibility of use, addresses sustainability and has an elevational treatment which recognises the broader civic context.

The finalists
Community Hospital of the Monterey Peninsula (USA), Hellmuth, Obata + Kassabaum (HOK)
Broadgreen Hospital redevelopment (UK), Nightingale Associates
Methodist Stone Oak Hospital (USA), Hellmuth, Obata + Kassabaum (HOK)
Acibadem Maslak Hospital (Turkey), Acibadem Project Management
Midland Regional Hospital at Tullamore (Ireland), Murray O'Laoire / Brian O'Connell Associates
The Knockbreda Centre (Northern Ireland), Penoyre & Prasad and TODD Architects
Children's Medical Centre Legacy (USA), Zimmer Gunsul Frasca Architects
Altnagelvin Area Hospital (Northern Ireland), HLM Architects in association with Hall Black Douglas
Ravelo Medical Clinic (Spain), gpy arquitectos
Northern Centre for Cancer Care and Renal Services Centre, Freeman Hospital (UK), Anshen + Allen
Meyer Children's Hospital (Italy), CPSE and Anshen + Allen
The Children's Cancer Hospital (Egypt), Jonathan Bailey
Peter & Paula Fasseas Cancer Clinic (USA), Co Architects
Centre for Integrative Medicine & Wellness (USA), WHR Architects
Duke-NUS Graduate Medical School (Singapore), CPG Consultants
Sir William Rous Unit, Kingston Hospital (UK), Broadway Malyan

Sponsored by
Farrow Partnership Architects
Farrow

Highly Commended
The Knockbreda Centre, Northern Ireland
Commissioned by: Belfast Health and Social Care Trust
Designed by Penoyre & Prasad in association with TODD Architects

The judges said: "This project successfully provides a closely integrated range of clinical, outreach and other services and creates a stimulating yet calming impression by recognising the need for a very human scale."

Altnagelvin Area Hospital, Northern Ireland
Commissioned by: Altnagelvin Area Hospital
Designed by HLM Architects in association with Hall Black Douglas Architects

The judges said: "The new South Wing sets an enlightened standard of design, giving functional clarity and a clearly defined interior. The full integration of varied, high-standard artwork is also noteworthy."

Winner

Meyer Children's Hospital, Italy
Commissioned by Azienda Ospedaliero Universitaria Meyer
Designed by CPSE and Anshen + Allen

The judges said: "Integrating a modern paediatric hospital into an existing architectural and landscape setting constituted a major design challenge, which has been successfully and imaginatively met by using the dramatic contours to full effect and by fully understanding the need to de-formalise the childrens' surroundings with a lightness of touch."

Prof Romano Del Nord of CPSE (centre) and Bill Rostenberg, Anshen + Allen (far left) receive the award from Prof Ostelio Remi, Istituto Italiano di Cultura (centre right) and judges John Ting (centre left) and Tye Farrow (far right)

Mental Health Project

Lead judge
Lord Nigel Crisp
House of Lords, UK

Panel
Dr John Zeisel, president, Hearthstone Alzheimer Care
Chris Liddle, chairman, HLM Architects

Criteria
Awarded for a mental healthcare facility where an effective reconciliation between issues of security and perceived 'openness' are evident and where the operational need for supervision does not overwhelm the imperative to provide a civilising and humane setting to support therapeutic intervention.The project should appear community-friendly. Evidence of safe landscaping is important, as are levels of construction specification to meet informed standards of sustainability.

The finalists
Day Centre for Children & Adolescents with Autism (Greece), Synthesis Architects
The Bluestone Unit, Craigavon Area Hospital (Northern Ireland), David Morley Architects in association with Hall Black Douglas
Centre for Addiction and Mental Health Phase 1A (Canada), C3, Montgomery Sisam Architects, Kearns Mancini Architects & Kuwabara Payne McKenna Blumberg Architects
Three Psychiatry Departments at Orsay Hospital (France), Gangneux

Sponsored by
HLM Architects

HLM ARCHITECTS

Highly Commended
The Bluestone Unit Craigavon Area Hospital, Northern Ireland
Commissioned by Northern Ireland Health Trust
Designed by David Morley Architects in association with Hall Black Douglas

The judges said: "The project teams' objective was 'the integration of internal space with landscape, defining clear routes through the building to enhance the patients' experience'. In this, the scheme has succeeded admirably."

Winner

Centre for Addiction and Mental Health, Canada
Commissioned by: RS G Commissioning
Designed by: C3, Montgomery Sisam Architects, Kearns Mancini Architects & Kuwabara Payne McKenna Blumberg Architects

The judges said: "In the field of mental healthcare it is rare to see so many hurdles cleared in one go, but the combined initiatives taken by the architectural, clinical and management teams result in a quantum leap for others to emulate. Humane vision, innovation and design skill go hand in hand to produce a measurable and conspicuous success of a high order."

Alice Liang, Montgomery Sisam (centre), Sheila Pitch, Centre for Addiction and Mental Health (centre right) and Terry Montgomery, Montgomery Sisam (far right), receiving the award from Lord Nigel Crisp (far left) and Chris Liddle (centre left)

Elderly Care/ End of Life Care Design

Lead judge

Derek Parker
Director, Anshen + Allen, USA

Panel

Dr John Zeisel, president, Hearthstone Alzheimer Care
Blair Saddler, senior fellow, IHI and past president, The Childrens' Hospital, San Diego
Timothy Toster, lawyer and hospice volunteer
Mivic Hirose, executive director, Laguna Honda Hospital, San Francisco

Criteria

Awarded for a scheme which succeeds in providing a 'natural' setting for terminal or elderly care, where the design not only suggests reassurance to patients and carers, but is also recognised as a positive attribute to the surrounding community. Projects must demonstrate that a balance has been struck between operational efficiency and the 'domestic' atmosphere necessary for long-term or terminal care and support. The demands of sympathetic supervision must have been reconciled with managerial effectiveness. Evidence of complementary landscaping is important, as are levels of construction specification to meet informed standards of sustainability.

The finalists

Community Nursing Unit, St Mary's Hospital (Ireland), Murray O Laoire/Brian O'Connell Associates
Viola Home (Finland), Arkkitehtitoimisto Erkki Helamaa Ja Keijo Heiskanen Oy
Sun City Park Yokohoma City (Japan), Perkins Eastman
Ontario Mission for the Deaf (Canada), Montgomery Sisam
St Francis Hospice (UK), Nightingale Associates

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Anshen + Allen

ANSHEN+ALLEN

Highly Commended

Sun City Park Yokohama, Japan
Designed by Perkins Eastman Architects

The judges said: "This beautifully executed project offers a residential care environment for the frail elderly on a campus comprising two linked villages in an immaculately landscaped setting. In being primarily aimed at the top end of the market, it is executed with a traditional formality appropriate to that group."

Winner

Viola Home, Finland
Designed by Arkkitehtitoimisto Erkki Helamaa Ja Keijo Heiskanen Oy

The judges said: "The provision of sheltered housing to include accommodation for the severely disabled, together with facilities for the surrounding community, led to a design which deliberately identifies with its urban setting. The appearance turns its back on superficial attempts to impress, emphasising its natural accessibility and reflecting an unforced sense of belonging."

The team from Arkkitehtitoimisto Erkki Helamaa Ja Keijo Heiskanen Oy and Viola Home in Finland receiving the award from Ms Satu Mattila, the Singapore Ambassador for Finland (third from left), and Bill Rostenberg, Anshen + Allen (far right)

Product Design for Healthcare Application

Lead judge

Colum Lowe
Managing director, Caulder Moore

Criteria

A manufactured product or item of equipment which is integrally installed in a healthcare environment and not only advances levels of technical performance within its specific field, but integrates satisfactorily with the setting designed to accommodate it.

The finalists

Norbury Ward Lounge Chair, Nightingale Associates
Operating Room of the Future, Olympus
Hand Washing Unit, Farrow Partnership Architects
Philips Ambient Experience, Philips Healthcare
Jaotech Smart Terminals, Jaotech
The Safevent Window, Britplas
Community Hospital Water Feature, Kloppenberg

Sponsored by
ARUP

ARUP

Winner

The Safevent Window
Developed by Britplas

The judges said: "The Safevent Window allows patients and staff to fully open a window in complete safety with no restrictions, permitting maximum natural ventilation. Due to its unique design, it has no locks or hinges and has self-cleaning glass. Its installation in over 100 acute locations is testimony to its operational success."

The team from Britplas receiving the award from Dr Milton Tan of Design Singapore (far right)

Culture and care

Following the economic dramas of the last year, the Middle East healthcare market is showing encouraging regional signs of maturity and vision for the future. *Veronica Simpson* looks at what might lie ahead

The global economic meltdown has claimed many casualties, and few as spectacular as Dubai, a city bristling with grandiose commercial (and architectural) schemes, many of whose financial foundations have recently turned out to be, literally, built on sand. But as the dust from the most spectacular crash clears, the region is showing itself to have pockets of stability and resistance, plus a sound long-term view on the importance of high-quality local healthcare.

"It's gone quiet but it hasn't gone silent," says David Derr, principal at Ellerbe Becket – about a market he's been active in for the last 30 years. Although a huge percentage of the schemes that were on the drawing board even a year ago are still currently 'on hold', the projects that are under way, and highlighted here, give clear evidence of a growing sophistication and integration of expertise that bodes well for the region's healthcare industry in the longer term.

Regional and climatic sensitivities

Healthcare architecture has evolved significantly since the first flush of demand for 'state-of-the-art' hospitals that largely imitated western models without adding to the local visual/architectural culture or customs. Furthermore, rather than fly in international consultants to take care of medical planning and infrastructure of new healthcare systems, many healthcare organisations are opting to get much more closely involved with the whole design and decision-making process in order to absorb the insights and experience into their own healthcare infrastructure.

In stark contrast to the energy-guzzling glass and steel towers that typified the first phase of the Middle Eastern construction boom – especially in Dubai – there is growing interest throughout the region in sustainability and a willingness to invest more upfront in measures that will pay off long term.

Nadia Tobia, principal in charge of Middle East healthcare projects at Perkins Eastman, says the interest in sustainability is now very strong. For the Al Maktoum Accident and Emergency Hospital in Dubai (see case study, p39), the practice is holding sustainability workshops for the Dubai government's environmental health and safety (EHS) department, in order to try to achieve LEED silver certification for its design. Planned measures include the use of high-performance glass and drought-resistant planting; local sandstone, which provides excellent heat-sinking and cooling properties, which will be used extensively throughout. "The client [the Dubai Government] is very supportive and very much on board," says Tobia.

One of the proposed lobbies for Ellerbe Becket's new cardiac centre in Bahrain

King Hussein Cancer Center (KHCC), Amman, Jordan
Client: KHCC
Size: 90,000m²
Cost: 96 million JOD
Schedule: 2010-2012
Architect: HKS
Consultants: Sigma-Consulting Engineers (local architect and engineer)

King Hussein Cancer Center (KHCC), Jordan

HKS has designed this facility – which promises to be the premier cancer research and treatment centre for Jordan and the region – as an architectural landmark, projecting an image that is progressive and contemporary while drawing inspiration from the local landscape and its history. It will have 152 adult and paediatric inpatient rooms, diagnostic and treatment facilities and outpatient clinics.

The existing facility was founded in 1997 and has links to many other cancer centres around the world, particularly in the US, but this new building represents an expansion of services, with a particular focus on outpatient care. Phase 1 of the redevelopment will focus on outpatient clinics. Phase 2 will include the inpatient rooms with diagnostic, treatment and outpatient services and Phase 3 will move all of the remaining inpatient and support services to the new cancer centre site.

Phase 1 construction will begin in early 2010 and is due for completion in 2012. Using a concrete frame as the structure, the facility is designed as two connected towers of 12 and 14 storeys, representing 90,000m² of clinical and patient space. The shorter, glass-faced tower is where the outpatient functions take place, and the taller tower will be where inpatient beds, diagnostic and treatment facilities are sited. The high-performance-glass curtain wall system above allows daylight to penetrate into six floors of inpatient beds, and the faceting of this glass is intended to represent a jewel, set in stone. Roof gardens will be planted with indigenous vegetation.

The facility will provide complete, state-of-the-art cancer care for adults and children. "The main focus was to provide flexibility and growth capability for outpatient clinics and services," says HKS principal Steve Jacobson. "What we've done is arrange on each floor a very flexible, multidisciplinary clinic design or model such that it can accommodate both their needs now as well as being flexible for future growth or as cancer care changes."

The facility is also intended to be an uplifting and healing environment. HKS senior designer Enrique Greenwell says: "We looked for visual inspiration to the city itself to try and create a building that belongs to the area, not something alien to the local culture and building techniques. We've made one side very open, with large expanses of glass that enable views of the new Amman but used Jerusalem stone to clad the side which faces the old town. Windows punctuate this solid wall in a stepped pattern that mimics the hills and buildings in the distance. Public areas such as the bridge, atrium and family lounges are exposed, with glass promoting openness. Its transparency displays the lifesaving activities occurring within the building."

Shaikh Mohamed Bin Khalifa Al Khalifa Cardiac Centre
Client: Government of Bahrain
Area: 30,000m^2 on 17-acre site
Architect: Ellerbe Becket
Schedule: two-year construction programme, likely to start September 2009

Shaikh Mohamed Bin Khalifa Al Khalifa Cardiac Centre, Bahrain

Ellerbe Becket has designed a 30,000m^2 cardiac centre for the government of Bahrain to replace an existing facility within the Bahrain Defence Forces Hospital. To reflect the health issues of the region, where diabetes is often one of the underlying problems for heart patients, the new 120-bed centre will combine state-of-the-art cardiac care with a renal transplant unit.

Run by one of the Gulf states' leading heart surgeons, Dr Resan Badran, the centre is billed as a 'five-star' facility. The seven-storey building will have four operating rooms and four cath labs. Single patient rooms are divided up into two 15-bed units per floor. Each floor will have a VIP room with a VVIP suite at the top. "The main circulation spine is on the ground floor and we've tried to make it as simple as possible to use," says Ellerbe Becket's David Derr.

An outpatient clinic sits to the left of the entrance, which has a two-storey lobby and high-class cafeteria nearby. All the outpatient and clinical functions are combined on this floor, including labs and imaging. The operating suites use an 'integrated interventional platform' devised by Ellerbe Becket so that cath labs are adjacent to the operating theatres, with all patients being fed through the same prep and recovery areas. "It's the same nursing staff that treats you on the way in," Derr explains. "People going home go to the stage-two recovery area and the patients who are staying will go to the PACU and then to their rooms."

Luxurious but locally sourced materials are used throughout, including marble and granite, as well as wood. High-quality fabrics and furnishings add to a sense of warmth and comfort. Situated in Alwali, on the south edge of Manama, the area is largely residential, so the building, while rising above most of the surrounding houses, aims to minimise its mass with its bulk divided into three segments, each oriented to maximise light while minimising solar gain.

The 17-acre site has been masterplanned for the possible future addition of a hotel for family members and residential housing for staff.

Though many projects have slowed or stalled – HKS estimates that it has 32 outstanding projects in the region – from a population and demographic point of view, the case for continued investment is too strong. As HKS principal Steve Jacobson says: "The need is there and the demand is there."

HKS's new King Hussein Cancer Center in Jordan (see case study, page 35) will serve as a beacon for cancer treatment in the area. Says Jacobson: "Many of the patients from the Gulf region would have found treatment in the US. Now the goal would be that they can receive that same quality of care closer to home." Although designed as architectural landmark, the facility's appearance draws on that of local buildings to ensure that it will have a more harmonious relationship with its surroundings.

One of the floors is dedicated to a range of extremely sophisticated labs and treatment facilities – including a 'cord bank' (where umbilical cords can be stored and their cells harvested for treatment). "That function doesn't currently exist in the region," says Jacobson. "This is a very well established institution providing a much needed service within Jordan."

Jacobson identifies three clear categories of ongoing investment activity. "The first is the higher end, for people who can afford to pay for treatment, wherever it is. Secondly is the building of the healthcare infrastructure for the local population and demographics – existing government-owned and -run hospitals have to be updated and replaced. These are being funded. The third category is more speciality-type hospitals that may be providing for niche services or as revenue resources or investments." HKS's Danat El Emarat hospital in Abu Dhabi, a 160-bed women's and children's hospital with orthopaedic speciality (as featured in the January 2009 issue of WHD) fits this mould.

Local and international attention

Turkey, though on the margins of the Middle East – and seemingly less hit by the economic tsunami – has also seen substantial investment, specifically from the Acibadem Healthcare Group, which has been upgrading its facilities across the country with an eye to the international healthcare tourist as well as the local population.

In many cases, the design and architecture skills have come from local practices. For example, the

Sheikh Khalifa Specialist Hospital, Ras Al Khaimah, UAE

The Sheikh Khalifa Specialist Hospital in the tiny emirate of Ras Al Khaimah – it boasts a population of just 300,000 people – is a 65,000m^2 248-bed medical facility, with speciality units comprising oncology, cardiology, a trauma centre and emergency department. Perkins Eastman's six-storey proposal incorporates the latest international design and medical planning solutions, and is intended to reflect the culture and customs of the region as well as sit comfortably in its dramatic natural environment. There are plans to eventually expand the facility to 400 beds.

"We do medical planning at the same time as architecture and interior design to ensure flexibility for the future, as well as creating a hospital that is friendly and non-institutional," says Nadia Tobia, principal in charge of Middle East healthcare projects at Perkins Eastman. "We tried to work up the site to minimise environmental impact, visually and functionally. It's a little bit outside of the city in a very beautiful red desert. There's no development around it at the moment, surrounded by red sand dunes and a national park to the north."

The sloping site facilitated a design that offers entrances on several levels to boost natural light, accessibility and privacy. "The movement of the dunes has influenced the shape of the buildings without affecting the clinical functionality," comments Tobia. "It even continues in the floor pattern from one side to the other, so that you feel aware of the surrounding desert even as you walk through the hospital."

While the exterior contrasts with the surrounding natural tones through the use of limestone, glass, and metal, the interiors reflect the desert palette with the addition of some bright colours.

Sheikh Khalifa Specialist Hospital
Client: Executive Committee for Developing Rural Areas/Ministry of Public Work, Dubai
Cost: n/a
Area: 65,000m^2
Architects: Perkins Eastman with Al Bayaty Architects
Schedule: completion 2011
Interior design: Perkins Eastman
Structural, civil and MEP engineering: Al Bayaty Architects and Engineers
Lighting design: Consullux Consultants/Crossey Engineering

Al Maktoum Accident and Emergency Hospital
Client: Dubai Health Authority DHA and Department of Health and Medical Services (DOHMS)
Cost: N/A
Area: 95,000m^2
Architect: Perkins Eastman
Schedule: completion 2012

Al Maktoum Accident and Emergency Hospital, Dubai

Perkins Eastman was chosen by the Dubai Health Authority DHA to design the most sophisticated accident and emergency hospital of its kind in the United Arab Emirates (UAE). Capable of providing immediate care for minor- to high-level trauma accidents and emergencies, the 300-bed, 95,000m^2 facility includes a five-storey nursing unit and a separate three-storey clinical services component with an emergency department which will be capable of handling up to 75,000 visits annually.

Rooftop and ground-level helipads and an ambulance receiving area are directly linked to a surgical trauma operating suite and a diagnostic imaging unit with MRI, CT, and X-ray capabilities. Additional spaces for diagnostic imaging, surgery, endoscopy, lab functions and an outpatient clinic are also included.

Acknowledging the importance, culturally, of facilitating the presence of large family groups in emergency situations, there are generous waiting areas provided within the atrium-roofed central spine of the hospital, plus coffee shops and retail outlets. Medical departments are located along the spine and the unique L-shape of the inpatient units allows for greater flexibility in the allocation and separation of rooms according to patient gender, as local custom would require.

Perkins Eastman is aiming for a LEED silver certificate for the project, although key elements still have to be approved.

renovation of the private International Hospital in the prime holiday location of Yeşilköy is on a par with the best facilities in the west, with interior designer Zoom TPU maximising natural light and the use of high quality local materials. The use of local materials and vernacular architectural styles in the 20,000m^2 extension to Kayseri Hospital also helps to achieve a building that complements and enhances the historical design of the original – designed by Lina Architecture with Zoom TPU.

As a region, there is every reason to hope, by the time it has stabilised, that there will be a substantial portfolio of excellent facilities for the local and the private market. But when is that likely to be? HKS's Jacobson predicts 2010 or 2011 for the more stable economies of Kuwait and Abu Dhabi, though Dubai may take a little longer. Ellerbe Becket's Derr feels Bahrain is relatively stable now, with Abu Dhabi and Qatar maintaining the pace of their healthcare investments.

Budgets are obviously tightly managed, but that is hardly anything new to architects, says Perkins Eastman's Tobia: "They always have a budget, and you do costings at every stage. These hospitals may look highly designed, but it's a hospital budget, not a luxury budget. And if the public areas seem luxurious (in comparison to government facilities in the West), it's because the use of high-quality materials in public areas is absolutely the norm in this region."

All in all, Derr believes the region is in good shape to achieve its desired aim: the marriage of the highest standards of clinical care with the sensitive treatment of cultural issues.

Veronica Simpson is an architectural writer

Designed to last

The fastest growing segment of the world's population is still the least catered to in terms of their specific life stage requirements. *Veronica Simpson* investigates

Welcoming colours at Penoyre + Prasad-designed Newhaven Downs House in Sussex, UK help residents feel less confused and stressed

Dignity, privacy and community are three of the key quality-of-life indicators for the world's over-70s, whether they are living independently or needing a greater degree of care. Yet the extent to which any of these elements are present in their lives, once their ability to look after themselves is compromised by ill health, is still hugely dependent on income and geography.

The US has long encouraged its seniors to relocate to vast and well-appointed retirement communities where state-of-the-art leisure and medical facilities create a haven for the elderly, whatever their mental or physical condition. In the UK, however, 'confused and fragmented' describes not just a state of mind but also the state of elderly healthcare as a whole. In part exacerbated by the multitude of care providers – social services, NHS, private sector – there has been little in the way of coherent thinking as to how best to house and care for older people in the long term.

The reasons for this situation are varied. First, the cultural perceptions of care for the elderly in the UK are that the state will provide – unlike in continental Europe where it is still seen as the duty of younger family members. Despite this, not enough public money has been invested in elderly provision, compared to other EU countries. What's more, little attention has been paid by the public sector to the kind of environment in which elderly people would choose to live. As one consultant said: "It's there in the private sector, if you can afford it."

But hard facts are beginning to raise awareness; the cost of social care for the over-65s in the UK is currently estimated at £10.1bn per year. By 2026 that's set to rise to £24bn to meet the demands of the over-75s – a population that is predicted to increase by 76% over the next 25 years. Enlightened new public and private residential schemes are starting to include housing for people at all stages of their lives, including the elderly, and offering adapted 'extra care' dwellings in their midst. There's a growing understanding that by keeping families, neighbours and friends close a more pastoral pattern of care can be accessed that enhances quality of life and eases strain on the system.

Design quality

However, the quality of architecture in new-build extra care or sheltered accommodation often leaves much to be desired, according to Sue Magyar, director at Hunters: "A lot of them are designed around what people feel older people like, which is usually pastiche architecture: small windows, pitched roofs, dormers, almost chocolate-box architecture."

Hunters recently designed an extra-care scheme that sits alongside a high-quality, contemporary private development scheme called Queen Charlotte's Hospital in London in which the quality of the materials and detailing of the balconies is the same standard as the private apartments. "The extra-care apartments are all two-bedroom (very unusual). There's a doctors' surgery, with between 8 and 10

Pendered Centre, Northamptonshire, UK

Client: Northamptonshire NHS Trust
Architect: Watkins Gray International
Project type: PFI
Schedule: Phase one completed December 2008, with Phase II scheduled to complete in May 2010
COST: £135m
Construction: Balfour Beatty

Pendered Centre, Northamptonshire, UK

The Pendered Centre project will provide facilities for dementia and acute conditions and comprises 135 continuing care beds in single ensuite rooms plus a day hospital and low secure unit. WGI formulated a 'zonal' approach, where patients can access mental health services specifically designed for their needs, yet which link into other areas, to provide a sense of community and shared experience. Chris Grayson, WGI associate and healthcare sector manager, says: "We have created a village concept based around elderly respite care, day care and continuing care for younger adults and elderly adults with acute and psychiatric care. There are shared spaces at the heart of the project, with catering, entertainment and leisure facilities that we also hope the local residents and visitors will enjoy. The purpose is to increase socialisation and encourage participation from non-patient visitor groups."

There will be six courtyards each designed to reflect which group will be using it or looking out on it, as well as wandering routes. The interior design scheme is based around different elements to assist with orientation.

GPs and a communal lounge, dining room and bar. Standards are improving," Magyar says.

If the quality of planning and accommodation for the elderly within the community is slowly improving, so is the thinking behind the design and interiors of elderly healthcare buildings. Penoyre + Prasad's two mid-1990s projects in Lambeth and Newhaven placed strong emphasis on wayfinding and orientation, through colour, texture, light and touch. "When designing for people with dementia it's really important that you don't create opportunities for rage and frustration when they get lost," comments Greg Penoyre. "You can help people distinguish between rooms where you are welcome as a resident by giving them door handles that feel pleasant and smooth to the touch and painting them welcoming colours. You put loops into the plan so that people's tendency to wander isn't thwarted. Corridors never lead to a dead end. And gardens have to be really easily seen – they have to be the other half of the 'wandering loops' and they have to be secure."

As a result of these initiatives, says Penoyre, "death rates went right down and visitor numbers went right up".

A range of multi-sensory orientation and wayfinding tools have now become the norm. Nightingale Associates' £17m Darlington West Park development in County Durham, finished in 2005, was able to harness an extensive art programme for the whole site that focused on a handful of key sculptural and decorative motifs that were then carefully deployed across the whole range of buildings to enhance orientation and wayfinding, as well as aesthetics. "Everything was oriented around a central sculpture at the heart of the development," says Rowland Phillips, project architect. All the buildings were T-shaped and interlinked, creating secure courtyards for each building and therefore minimising the need for fencing."

Watkins Gray International is half-way through the construction of a new mental health and elderly care facility in

Wexford Creek Campus of Care

Client: Good Samaritan Canada
Architect: Stantec
Cost: CDN$30.5m
Completion: 2008

Wexford Creek Campus of Care, Canada

Good Samaritan Canada's new facility in Nanaimo, British Columbia offers a continuum of care in three distinct types of accommodation (independent-living apartments, complex care and mental health cottages) for residents on one site. The project was developed on a brownfield site with stringent requirements for storm water management and a naturalised riparian setting for the facility, which is currently undergoing restoration.

The independent-living component of the campus includes 40 self-sufficient apartment units. All units are fully wheelchair-accessible and are designed to ensure residents with a variety of abilities can live independently. The campus also accommodates 80 complex-care beds organised into 8-10 bed units. The plan is organised around private courtyard gardens with the more transparent common rooms at each end allowing residents safe access to a protected outdoor space which is readily observed by staff and volunteers. The third accommodation type on the campus is located in the cottages which house up to 10 residents with varying degrees of dementia within an intimate residential setting.

Northamptonshire which incorporates many of the above practices and builds on them. It is currently being viewed as something of an exemplar (see case study).

Best practice in the US

Anshen + Allen has been working on some encouraging public facilities for the elderly in California, which do much to provide dignity, privacy and community for a range of lower-income patients requiring long-term care, including the elderly. Senior principal Sharon Woodworth and her team, working across Laguna Honda Hospital and Edgmoor Skilled Nursing Facility, took great pains to create massive healthcare facilities which give patients a choice as to how much or how little they want to mingle with the surrounding patient neighbourhoods.

Laguna Honda caters for the full range of acutely ill and severely disabled populations of all ages, from coma patients to dementia patients requiring long-term care. Inserted into maturely planted landscape between two hills on the existing historic facility, the link building is based on a horizontal layering of spaces which will house whole hospital facilities, but provide easy navigation between old and new facilities. One of the principal challenges for the architects was breaking down the 1200-bed facility into manageable spaces that could somehow feel as domestic as possible, given that some patients will be living out the rest of their days there. "We broke it down into neighbourhoods and households," Woodworth explains. "Each household has 15 bedrooms and four households come together to create a 60-bed neighbourhood." There are 20 self-contained neighbourhoods around the facility, each with their own dining and living facilities. Bedrooms may be shared with one or two others, with curtains separating the beds. Bedrooms for three residents have private sleeping suites with sliding screens instead of curtains and each suite shares a bathroom. The beginning and end of each neighbourhood is reinforced by the architecture and artwork. There are walls where the staff might have preferred a continuation of corridors but Woodworth insists endless corridors should be avoided at all costs. A full range of sensory cues maximise recognition of neighbourhoods and households, chosen to suit the particular patient household.

Anshen + Allen's designs for the 192-bed long-term Edgmoor Skilled Nursing Facility maximised the power of gardens and the healing landscaping, with three blocks of patient spaces staggered to provide natural seclusion and security. Each block has three two-storey wings of patient rooms. The fourth wing is the shared space. Woodworth says: "The fourth wing has accessible terraces so the patient can choose to be outside or sit inside and see what's going on. When people are in this space they can appreciate a beautiful alignment with nature and greenery."

The transition from public to private space is clearly signalled by the solid corridors and wings of patient rooms and the feeling

of privacy is further reinforced from bedroom to common room. "There are three hallways facing one intersection – an interaction intersection with a skylight, focusing on those corners where the three corridors come together. Once they are in that corner, they can see into the fourth wing. It's fully open." This level of attention to detail is intended to minimise stress and maximise choice and engagement within the patient community.

Another US giant that has done much to evolve the practice of elderly healthcare architecture, Perkins Eastman, has long flagged up the benefits of creating more defined, personal spaces for care homes by breaking accommodation down into 10-bed households and ditching the nursing station – integrating all the necessary facilities and equipment into the communal kitchens. It has further developed the array of cueing components to facilitate wayfinding and orientation for those with memory impairments, including variations in flooring – wood, tile, carpet – wall coverings, acoustics and lighting, and the invention of 'memory boxes', which can be placed at the entrance to each room and feature a significant photo or object chosen by the resident themselves.

West meets east

Recently Perkins Eastman has been transferring the US model of luxury retirement communities from the US to Japan. David Hoglund, principal and CEO, says "Japan is probably on the leading edge of what we are seeing happening now. There's been a huge cultural shift. Retirees are not retiring at 62 with the prospect of moving in with their children. They want to be off playing golf and enjoying life.

"In the US [where the average age in a retirement community is between 78 and 82] it's more needs-driven. Here it's a lifestyle choice, and that's partly because the typical residential housing in Japan is not very accessible." Hoglund adds: "People get to a point where their knees or hips ache, and they want to live in a more accessible community with access to great dining and leisure."

The East Village Spa Juice Bar in Japan's Sun City Yokohama

The Perkins Eastman-designed 480-bed Sun City Park in Yokohama is split into two blocks, or 'villages', each with its own character and facilities. One village focuses on leisure and culture, with musical and theatrical events regularly staged at Sun City Hall, and the other has extensive health and fitness facilities, including a beauty spa and swimming pool. The two villages are linked by a bridge over the stream, providing a charming and formal 'welcome' to each area.

A second project designed by Perkins Eastman, Sun City Ginza, offers 31 storeys of residential and leisure facilities – one of the very first high-rise retirement community buildings. A six-storey podium base is capped with a 26-storey high tower. The podium is made up of two levels of public space at the street, with 134 units of nursing-specific floors above. Double- and triple-height spaces at either end of the base provide a dynamic presence at the street, as well as serving to tie together the living environments. The tower offers 276 independent living apartments on 24 floors and is topped by the two-storey Harborview Restaurant and Ginza Bar. The interiors and furnishings are geared towards being as uninstitutional as possible, while allowing for reduced mobility.

"The client's background is in hotels, retail and hospitals," says Hoglund. "These places are all about service."

Back in the US, Perkins Eastman is currently at work on several retirement community projects which are specifically weaving in opportunities for wider social engagement, one of the most interesting being New Bridge on the Charles River in Massachusetts. Designed by Perkins Eastman and Chan Krieger, it's an intergenerational campus for Hebrew SeniorLife. Located on 153 acres of land along the river, it will include a 100-pupil children's day care centre, a Jewish K-8 day school for 450 students, a summer camp, a Jewish community centre, a 268-bed long-term care facility (220 long-term care and 48 sub-acute), 51 assisted-living apartments, 182 independent-living apartments, 24 villas and 50 cottages.

With such a breadth of choice of elderly-friendly accommodation and a community remit to foster intergenerational support, we can only hope to see more models like this becoming the norm worldwide.

Veronica Simpson is an architectural writer

Active Ageing

Phil Astley describes four top-quality European facilities for people with dementia that have successfully integrated a real understanding of older people into their design

National governments are currently raising the disease profile and renewing social commitment to their ageing populations, recognising them as a complex and diverse group. This is reflected in the high-quality and innovative planning and design of facilities in community settings. The following four case studies are a review of facilities seen by the Medical Architecture Research Unit (MARU) in field visits to France, Finland and Spain between 2005 and 2008. Finland has a system of homecare that provides nurse-led medical care at the patient's home, assisting in daily tasks and prescribing for chronic conditions. The home carer can identify potential changes in the health of their patients, thus making early diagnosis and treatment much more likely.

Viola-koti, in the district of Tampere, north of Helsinki, is a facility with a mixture of support services, from day access for those still living in their own homes (respite care) to residential accommodation for those requiring intensive nursing care for advanced forms of dementia. In addition, people can choose to rent or buy a flat in the building and use the facilities as they wish.

Residential nursing at Viola-koti is free regardless of income, with fees paid by the local municipality. The activities include gym, swimming (hydrotherapy), craft classes, fitness classes and a fully accessible level-access sauna. Additional services such as laundry, a communal restaurant (accessible to the local community) and cleaning are available too at a small cost.

"Laugh and you will live longer" is the motto of Helsinki's Kamppi Service Centre, where residents run craft and recreational schemes

A key design feature here is an external veranda with bi-folding windows. It means that even in the colder months, a view to the outside, with safe access, is possible – when the ability to read and write has disappeared, being able to engage with people and watch the day-to-day comings and goings of town life is essential.

The Kamppi Service Centre in central Helsinki has some 2,400 visitors per day. Its philosophy is "laugh and you will live longer." A vibrant range of craft, canteen and recreational facilities are run by the users, including shoe-repair workshops, weaving and dressmaking. A small on-site health facility gives people who have continuing daycare the opportunity to access services at a cost of €12 per day; the space includes a quiet corner with day beds for those with advanced dementia who require nursing care, enabling their carer or partner to enjoy the activities alongside them. The centre's design is all about enhancing people's dignity and independence. Different spaces allow for different types of engagement and withdrawal – at the user's own pace.

By contrast, in Spain, the Madrid Alzheimer's Centre is a 12,000m^2 structure with some 156 beds and a 40-place day centre. This centre is integrated with a biomedical research and training unit complete with MRI scanner, full autopsy facilities and laboratories, established to investigate the cause of Alzheimer's disease with a view to prevention and treatment – the Spanish Ministry of Health's response to an anticipated 75% increase in Alzheimer's over the next 25 years. Teaching is not restricted to academia but is also available for relatives, carers

and care groups as part of a holistic approach to embracing the whole spectrum of care.

The centre's residential units are independent of each other and comprise nine double ensuite rooms and day facilities. Innovative technology – passive infrared detection units and remote monitoring particularly at night – is brought together with restorative courtyard gardens, plant aromas and themed artwork that creates recognisable zones without the need for signposting. An essential feature is the integration of horticultural therapy (part of a wider occupational therapy programme) in a garden adjacent to the residential areas.

Paris's Residence de l'Abbaye bucks the patronising approach to ageing by providing a 'salon' on a 'street of activities' for discussion about the political and societal issues of the day. The aim is to help residents maintain a relationship with the outside world and therefore retain control of their own lives in a safe and secure environment. The average age of the residents is more than 86 years. A 46-bed unit for those with Alzheimer's disease is part of the larger residential apartment blocks, which each have a consultation surgery space on the ground floor for weekly visits from two site-based GPs and a pharmacist. A travel club coordinates social visits and the dining room allows interaction not only with other residents but also with the crèche for nursery children co-located on the site. Interaction between the children and residents – through storytelling, drama, music and art therapy – is encouraged, helping the residents to feel useful, needed and more active.

From the UK perspective, these facilities have a humbling effect, providing a high quality of design response that integrates older people and those living with dementia into the urban fabric of their local communities. The residents' independence is promoted by the architecture, with a complete understanding of the condition of the needs of the older person, from the choice of materials through to environmental control and comfort. These are designs without compromise to privacy, dignity or respect, and they place the comfort and enjoyment of residents and their carers firmly at the centre.

Phil Astley is a senior lecturer in the Medical Architecture Research Unit (MARU) at London's South Bank University

Above: The horticulture therapy garden in Madrid's Alzheimer's Centre is an essential feature of the facility

Above Left: A glazed verandah at Viola-koti, Finland, allows residents to observe the daily goings-on of life even in deepest winter

The Ponta beam system

More than good looks

Two Dräger products are recognised in the 2009 iF product design awards

The annual International Forum Design (iF) product design awards recognise products which succeed in combining functionality with convenience and aesthetics as well as satisfying the requirements for innovation. A total of 2,808 products from 39 countries were submitted in 2009, from which the international selection committee presented 802 with awards for superior product design.

Among the winners were the Ponta beam system and the Infinity C700 for IT workstations from Dräger, some of the first Dräger products developed according to the company's current design guidelines. The Hannover-based iF recognised the Dräger products for their innovative product design in the category 'Medicine/Health + Care'. The ceiling-mounted supply unit Ponta integrates not only extraction points for gas, electricity and IT connections but also dimmable light sources.

Based upon different requirements, monitors, infusion pumps and consoles at intensive care workstations can be attached in various ways and moved around on trolleys. The Infinity C700, the cornerstone of Dräger's Omega widescreen solution, is a medical-grade workstation that combines an industry-standard CPU with a 50cm-wide touchscreen colour display that makes information easy to see, even from a distance. The fan-free design lowers noise and dust levels, and the optional rotary knob provides navigation in addition to the touchscreen.

The iF product design award is one of the most important design competitions worldwide. The committee's criteria include: quality of composition, workmanship, material selection, degree of innovation, environmental sustainability, functionality, ergonomics and safety. Features such as these reflect the fundamental requirements of today's hospital sector for medical devices such as the Ponta beam system or the Infinity C700 for IT workstation.

Introduced in 2006, the Dräger Industrial Design Manual played a decisive role in the development of these two products. Among other things, it establishes rules for characteristics such as colour, shape, labeling and choice of materials used for Dräger medical products. The goal is to achieve a distinct company-specific shape common to all Dräger products at a medical workplace. In addition to the manual, teamwork and international coordination were key factors in the design and realisation of the Ponta beam system and the Infinity C700 for IT. The development of the Infinity C700 for IT was the result of a close collaboration between Dräger development teams in Lübeck and Andover, Massachusetts (US) and the design agency Corpus-C.

www.draeger.com

The Infinity C700 for IT workstation

Restore, revive

When CSPE and Anshen + Allen were asked to convert a former TB institution into a children's hospital, the result combined old aesthetics with state-of-the-art modernity. *Cristina Donati* reports

The Meyer Hospital in Florence brings together advanced technology and environmental sustainability in a unique setting – a 1930s villa set in a protected parkland of mature trees, surrounded by the renowned Florentine hills. The site demanded that its environmental and cultural heritage be transformed and updated with continuity and innovation; architects CSPE and Anshen + Allen brought together these contrasting aims in a mimetic building, embedded in the hillside, that integrates old and new, creating synergies between the original Ognissanti Villa, the landscape and a new pavilion.

Conceived as a piece of 'land-art', the new architecture, observed from above, shows an innovative topological approach that harmonises the building morphology with the contour lines of the hill, making it appear as a natural element of the land. Despite its size (76,598m^3), it blends in with the lush hillside thanks to a strong environmental strategy. The three floors are tapered and staggered, creating overhangs with large, landscaped terraces crowned by a green roof that offers spectacular views of Florence.

The hospital entrance is a three-storey traditional building that has been accurately restored. The reason, explains CSPE director Romano Del Nord, is that "we wanted to create a memory of the past while reducing the stressful impact of a typical hospital structure." Arrival into the hospital has been diluted through layers of accessibility. Going through the main entrance, one enters a glazed passageway that threads through a 'healing garden' and then into the generous atrium space that stitches together the old and the new.

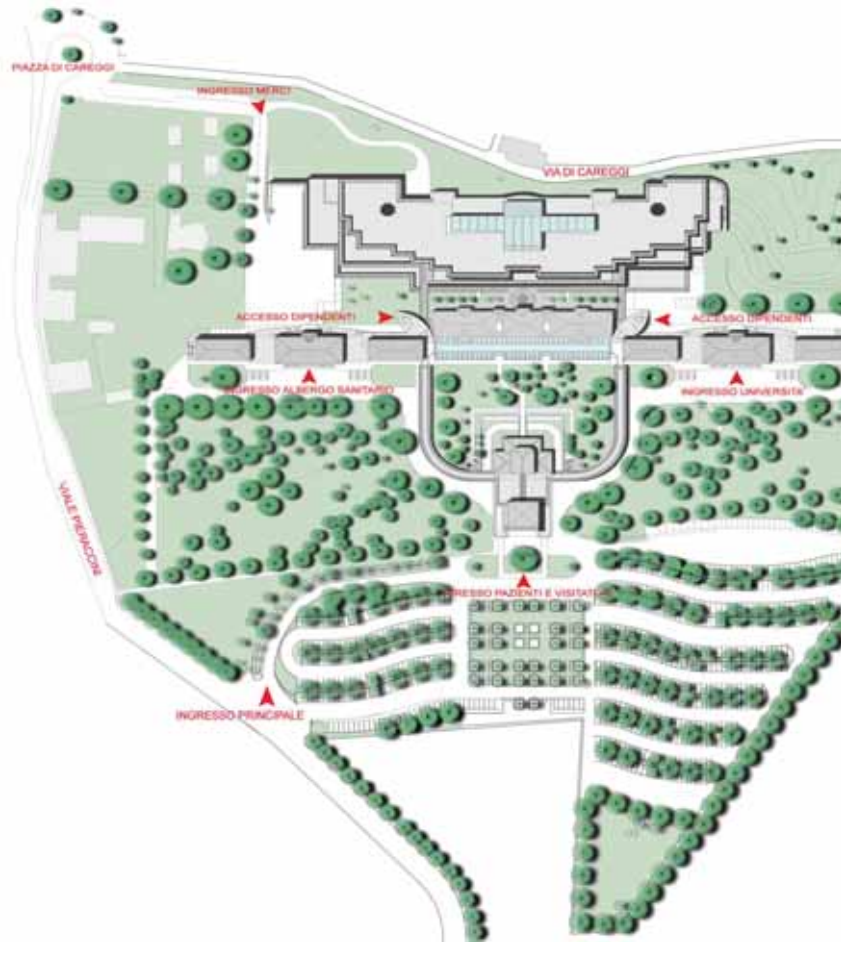
Remodelling for today's needs

Villa Ognissanti was originally built in 1930 as the first institution in Florence for the treatment of tuberculosis. Its plan, based on a triple-block design, wasn't easy to alter to meet the needs of a modern-day hospital. Nevertheless, the new design was able to retain the cultural heritage of the old structure and integrate distinct and separate functions into the renovation of the three blocks.

The east wing hosts the university and research unit; the west wing, the outpatient facilities; and a central block houses the administrative department. The elevations have been painstakingly refurbished in accordance with the principle of restorative conservation, with the exception of the central façade, which is screened by a large greenhouse that floods the new atrium with sunlight. The traditional Tuscan architecture of the villa is enhanced by new technology, which emphasises efficiency and quality of care.

The hospital's strength lies in the way in which it has overhauled not only the technology, but also the culture of hospitalisation, without compromising the identity of the new architecture. Its design was conceived as a unitary system of green areas, where technology and materials bring about the sustainable balance of structure, technology and environmental sensitivity.

In 2000, the project received funding from the EU to accomplish the best sustainable procedures and promote energy saving. A number of eco-friendly solutions have also



Meyer Children's Hospital, Florence

Opening date: December 2007
Project budget: €57m
Client: Azienda Ospedaliero Universitaria Meyer
Architects: CSPE (Centro Studi Progettazione Edilizia), Florence, and Anshen + Allen, San Francisco
Project manager: Paolo Felli, CSPE
Main contractor: Itinera, Gemmo Impianti, COGEPA
Environmental psychologists: Prof Mirilia Bonnes, Marino Bonaiuto
Healthcare specialist: Prof Mario Zanetti
Structural engineer: A&I (Architetti e Ingegneri Associati); Studio Tecnico Chiarugi
Mechanical engineer: CMZ (Cinelli – Marazzini – Zambaldi)
Electrical engineer: Studio Lombardini Engineering
Environmental sustainability programme: Centro ABITA

The Serra (Italian for greenhouse), which contains the atrium and main reception desk, has a structure echoing that of the surrounding trees

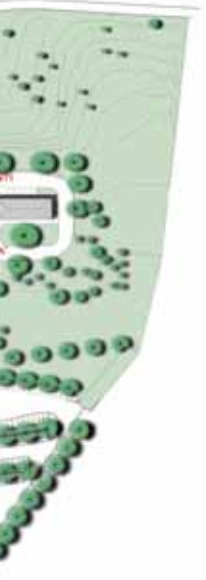
been implemented both in the renovation of the villa and in the new pavilion. Villa Ognissanti features a new ventilated roof, shading devices and façade grills that favour natural ventilation.

The most impressive element, however, is the bio-climatic entrance hall called the 'Serra' (greenhouse) that acts as the public face of the hospital. This curved triple-height space, attached to the central wing of the villa, is an innovative atrium that turns sustainability into a language of materials, textures and colours. The laminated wood pillars reflect the shape of the surrounding trees, and incorporate building-integrated photovoltaics (BIPV) that enhance the aesthetic of the façade, filter natural light and produce electricity up to 31 kWp.

The green roof, besides being a sheltered, healing garden for patients, provides an insulated covering which naturally lowers the temperature inside the hospital by several degrees and plays a leading role in the energy balance of the building.

Conical skylights, called 'cappelli di Pinocchio' (Pinocchio's hats – the children's story inspired many design details), pierce the roof and together with 47 'solatubes' provide the interior with natural lighting. Quality of light and lighting play a fundamental role in environmental and psychological wellbeing, and good climactic conditions as well as the orientation of the building maximise natural light and the visual relationship with the landscape. This allows patients to experience the changing of light and the passage of time and of the seasons, helping to reduce any sense of isolation.

Materials, light, visual art and the landscape perception create a harmonious and positive physical, as well as psychological, atmosphere which improves the culture of the children's hospital thanks to criteria that extend beyond a strictly functionalist agenda. Massimo Resti, head doctor of paediatric medicine, agrees: "Colour, light and contact with the landscape maximise privacy and safety without compromising on the high level of care."



Function and orientation

Thanks to a large parking area, the entire hospital campus has been conceived as a single car-free system of green areas where wayfinding is a constant priority. Two glass-enclosed staircases link the old villa with the new circulation, which is divided according to users – staff, visitors, patients and goods. Each level hosts compatible functions: the basement houses plant as well as a multicultural spiritual space; on the ground floor are outpatients departments, first aid and imaging, the reception area, shops and a cafeteria; on the first floor there is an operating area with seven theatre suites and intensive, specialised care units. The majority of the patient-focused areas are on the second floor, with some on the first floor (polifunctional intensive care, infectious diseases and the isolation ward).

The ward arrangement has been designed to allow future flexibility and adaptability. Patients' rooms are concentrated on one side, with medical services on the other side. This layout creates a central distributive space of variable width, in which there are four work areas for the staff. It is a 'cluster' scheme, with a curving circulation spine that removes the oppressive feeling of old-style narrow institutional corridors and offers a more open and friendly way to live and work.

The innovative ward layout creates two particular areas by the patient room: an exterior area, delineated by the overhang, which can be used as a protected open space; and an interior space overlooking the distribution area, offering a secluded space and a meeting point for parents and doctors. All rooms have double windows, one that overlooks the landscape, and

another that enables staff to discreetly oversee the patients. The rooms (30m^2 for the double room, 24m^2 for the single) are equipped with sofa beds to allow parents to stay with their children.

"The innovative design strategy implemented for the new Meyer has filled in the gap between technology and humanisation," explains Monica Frassineti, the hospital's chief executive doctor. "The result is a stress-free environment with many child-friendly features."

A glazed passageway leads to the atrium with its ingregrated photovoltaics on the exterior

Research-driven design

Anshen + Allen's Derek Parker and Felicia Cleper Borkovi together founded The Children's Hospital Explorers (CHEX) to encourage a multi-disciplinary discussion about the design of the built environment for sick children and their families. CHEX aims to understand more about the link between facility design and quality improvements for paediatric patients, families, and staff: Parker and Cleper Borkovi believe that children's hospitals should be "caring and supportive of the individual child/family, non-trendy, and timeless". Furthermore, they say that "the children's hospital environment should be safe and secure, and be a backdrop for varying ages and cultures. The environment should not only allow children to arrange their space to suit their individual needs, but it should be designed to encourage it."

CSPE director Romano Del Nord is a leading theorist on evidence-based design and chair of TESIS, the Florence Inter-University Research Centre for Systems and Technologies in Healthcare which, since 1992, has been examining evidence-based design with particular attention to children's hospitals and their quality of care. To support and foster the Meyer design, Del Nord coordinated a national research team investigating all possible strategies to prevent environmental stress and maximise psychophysical wellbeing conditions in hospitals. The results of this research were subsequently published in Environmental Stress Control in Children's Hospital Design (Milan 2006, edited by Romano Del Nord).

Together, CSPE and Anshen + Allen led an interdisciplinary design team made of consultants in environmental psychology, sociology, ergonomics, landscape architecture, visual art and health management and implemented their findings into the design of the Meyer Hospital. The innovative methodology used the best evidence regarding light, sound, art, air quality, colour and nature. As a result, the interiors have been enriched with play corners, recreation areas, colourful signage and works of art everywhere – designed to make the children feel more at home and less like they're in a hospital. "The suggestions expressed by 500 Florentine children interviewed during a conference naturally became part of the brief, and turned the hospital into an ideal place for childcare, where visual art and interior design are child-focused," recalls Carlo Barburini, chair of the Meyer Foundation, which was set up in 2000 to provide support and monitoring for the development of the project. The Foundation endeavours to serve as a point of reference for all the professionals and technicians who are responsible for ensuring the best possible quality of life for children, as well as the most advanced forms of treatment.

"The design strategy has filled the gap between techology and humanisation"

"Meyer is the original outcome of a long-standing Italian tradition of childcare: a tradition that believes in children's dignity with a commitment to the highest levels of care," says Meyer's CEO Tommasso Langiano. "The hospital is designed and built to maximise aesthetics, technology and the environment to ensure the wellbeing and comfort of patients, families and staff." It is also the result of an inter-disciplinary team sharing the challenge to create a patient-focused facility – one of the first successful examples of a form of experimentation whereby the architecture interprets the perception of space through infant psychology in order to create a true hospital for children: a hospital for the future.

Cristina Donati is an architectural writer and an architect with CSPE

Metaphors for healing

The concept of transformation is central to UPMC's new family-centred children's facility in Pittsburgh – a space that is energising, secure and sustainable. *Tim Powers* explains

Already internationally recognised for its outstanding clinical services, research programmes and medical education, Children's Hospital of Pittsburgh of UPMC opened a new facility in May that is a model for paediatric healthcare. Astorino, which created the facility on a 10-acre campus, aimed not only to meet people's deepest needs but to incorporate practical elements such as safety, security and sustainability into the overall design. The hospital positively impacts the healing process for children, more than 500,000 of whom visit each year.

It's all about people

To address the innermost needs of patients, families and staff, Astorino used deep design research from its affiliate company, Fathom. From this research, metaphors emerged for the ideal child experience, which then served as design guidelines for the new hospital and are represented in a number of key features throughout the facility.

Transformation became the over-arching theme, while control, connection and energy were identified as supporting metaphors. Astorino integrated the underlying theme of transformation throughout the hospital in an effort to guide patients and their families through the arduous process of treatment and healing. It starts before patients even see a doctor, with a walk through the 'transformation corridor', a hallway that connects the parking garage to the hospital's main lobby, where the change in seasons is represented in the floor and an impressive wall mural depicts beautiful butterflies emerging from an Escher-like pattern.

An atmosphere of positive energy pervades both the inside and outside. The inpatient atrium, for example, a central gathering point, can be used for energising activities such as watching educational or entertainment programmes on a two-storey projection screen.

Patient rooms were turned into intimate and private spaces that are kid-friendly, allowing children to take control over elements such as lighting and display of personal items. Comfortable, semi-private sleeping areas for parents were created in the patients' rooms, and intensive care rooms also accommodate sleeping areas and private bathrooms for family members.

Astorino's guiding design theme was the idea of transformation; it created a 'transformation corridor' between the parking garage and the lobby, with colourful flooring and a huge mural

A four-storey atrium leads to a 370m^2 rooftop healing garden. Patients who might not be able to physically reach this space are still able to see it; the windows in patient rooms above the atrium provide views of lush green plants, the sun fountain and the sparkle of stars and moons embedded in the stone path – fostering a sense of belonging to the world and being at one with nature.

Safety and efficiency: key priorities

Safety and security were also a top priority for both the hospital and Astorino. The standardised patient rooms have the same basic floor plan and layout of furniture, supplies and medical equipment, helping to increase medical efficiency. The resulting clean and organised workplace eliminates 'hunting and searching' and ensures that all materials needed for patient safety are readily available. It also helps to free up healthcare workers to focus on patients' needs.

Proper separation of materials from patients, as well as preventing the overlapping of different patient

populations, can also help substantially reduce infection rates. Astorino therefore used specific architectural features to help manage internal traffic of staff, patients and materials within the hospital: for example, inpatients and outpatients are kept on separate floors, and there are designated elevators that do not allow overlap. Similarly, separate elevators for soiled and clean materials minimise patient contact with airborne contaminants.

Care-team stations offer a spacious work desk where doctors and nurses can clearly see patients while still having privacy to conduct conversations among themselves. This open space promotes a collaborative work environment where medical staff can make smooth transitions between shift changes.

The healing garden, with its quiet spots complete with rocking chairs, tables and benches, is where patients, family members and staff can relax and enjoy the outdoors without leaving the grounds

Adaptable to disaster

In response to the hospital's disaster preparedness plan, the building was configured with adequate soft space for use in the event of a regional disaster. The main lobby, transformation corridor, ambulatory court, undercover driveway and atrium are sized to handle care-giving stations, and the trauma centre can be expanded to accommodate a surge of patients.

Throughout the building, there are 'rings' of varying security, with specific architectural distinctions and barriers. As the visitor moves through the hospital, they must pass through these increasing levels of security, a system that prevents unauthorised persons from gaining access to sensitive data, access to patients and/or private areas within the facility.

Recognising the relationship between sustainable design and patient healing, Astorino and the hospital partnered to achieve a Leadership in Energy and Environmental Design (LEED) certified design. The hospital's environmentally sound design and unique approach to the procurement processes for HVAC and low-voltage systems contribute to the overall health and safety of patients and staff, and facilitated the LEED certification process of eligible buildings.

In accordance with the US government's mandate to digitise healthcare records by 2014, the Children's Hospital is a paperless facility. This initiative not only saves trees but it also saves staff time, and can greatly reduce patient risk as caregivers have real-time access to medical records, regardless of location.

Wherever possible, construction materials were recycled and local, reflecting the hospital's commitment to go green beyond traditional means. Other sustainability initiatives include low-VOC materials such as sealants, adhesives, paints and carpets; water-efficient landscaping; air filtration systems that increase indoor air quality; and maximum use of daylight and views.

"We've designed and built a hospital that is unparalleled among paediatric hospitals nationwide in terms of its emphasis on patient safety and family-centred care, its level of technology and its environmental sustainability," says Eric Hess, the hospital's vice president and project executive. "From the parking lots to the spacious, private patient rooms, each and every aspect was designed to improve the healing environment and to make patients and their families as comfortable as possible during their stay."

Tim Powers is senior vice president of Astorino

Inherently energising, the lobby sets the tone for the building, with its bright colours, artwork, natural light and large open spaces

Alexander Denmarsh

Design &Health
International Academy for Design and Health

Design & Health Scientific Review
The Devil is in the Detail

Dr John Zeisel is chair of the international advisory board of the International Academy for Design & Health and president of Hearthstone Alzheimer Care

This issue's articles demonstrate how evidence-based design can benefit from detailed analysis of design competition winners, environmental perception interviews, and research methods.

Cadenhead and Anderson study an overlooked source of design data – competition entries. The submissions included detailed descriptions of Intensive Care Units (ICU) in hospitals worldwide submitted over 17 years to a group of doctors, nurses, and architects. The data include not only plans, photographs and budget data, but also "a video walk-through with a voice-over description of the unit and the attributes the staff feel are especially important." What a rich source of data!

Cadenhead and Anderson first describe in detail themes and trends they see in the data, and then draw from them evidence of successful design practice. What do they find? Since 1998 no winners included shared bathrooms in any ICU. E-glass that becomes opaque when electrically charged and in-room bar-code scanners are prominent technological advances. No winner employed exclusively centralised nursing support, while stress-relieving access to nature for staff – a particular interest of neuroscience in architecture – appears to be on the upturn, as are space for family in the ICU and access to gardens for patients.

Pati and Harvey's study of flexibility in medical-surgical inpatient units pays similar attention to detail. Their data are focused interviews with 48 managers, nurses, and support staff in US hospitals. The authors address how architects often design capabilities into their environments without understanding how the "end-users" of their buildings perceive those characteristics.

They identify three sub-categories of flexibility – adaptability, convertability, and expandability – and analyse the transcribed interviews to determine how the respondents defined "flexibility" from their perspective. Of particular interest are the dimensions of flexibility that "have physical design implications." Like Cadenhead and Anderson, the authors identify a handful of specific design characteristics of ICUs that are important to users. Interestingly, none of the respondents mentioned single patient or universal rooms.

Forbes and Fleming assess a particular method to be employed in a larger study of community-based residential Alzheimer's care. The detailed sub-study they carried out to assess the qualities of their Environment Audit Tool (EAT) will serve them well in the major 3-year Australian study in which they are engaged.

Carefully establishing that their audit tool is relevant to today's broadly accepted person-centred Alzheimer's care approach, they identify important failings of earlier instruments: that they were developed to assess institutional Alzheimer's care settings – Special Care Units (SCU) – which have now been replaced with smaller scale domestic, assisted living, and care home settings; and that one of the earlier scales addresses physical environment characteristics, not in design terms, but in terms of maintenance, cleanliness, and "odour from bodily excretions." Design tools must inform about the clinical effects of the physical environment, and address design issues like safety and security, size, visual access, stimulation, familiarity and the other characteristics.

Altogether these three articles make important contributions to the design and health literature in terms of focus on detail, analytic rigor, and defining evidence-based design criteria for ICU's, inpatient units, and residential Alzheimer's care.

For the full comment, visit, www.worldhealthdesign.com

Inpatient Unit Flexibility:

Design characteristics of a successful flexible unit

This study looks at flexibility in healthcare design from the perspective of the end user and how the physical design of a facility impacts on both staff and service delivery

Debajyoti Pati, PhD, FIIA, LEED AP, Thomas E Harvey Jr, AIA, MPH, FACHA, LEED AP

Flexibility in healthcare design is typically addressed from an architectural perspective without a systematic understanding of its meaning from the viewpoint of the end user. Moreover, the architectural perspective has generally focused on expandability and convertibility. This study explored flexibility needs in adult medical-surgical inpatient care with the aim of understanding its meaning from an end-user perspective, as well as identifying the characteristics in the physical environment that promote or impede stakeholders' requirements. We used a qualitative design and conducted semi-structured interviews with 48 stakeholders in nursing and nursing-support services at six hospitals across the US. Data was collected from September to November 2006. The findings suggest that adaptability influences more aspects of unit operations than convertibility or expandability. Furthermore, physical design characteristics impact on nine critical operational issues where flexibility is required, spanning nursing, environmental services, materials management, dietary services, pharmacy and respiratory therapy.

Introduction

Discussions in healthcare literature on flexibility are few and far between. However, substantial thought is available with regard to retail and workplace settings. Notable is the historical demand for change arising from such factors as technology, finance, and fashion[1], and a layer-based structured approach to building flexibility[2].

Recent healthcare literature reflects similar thoughts. One thesis infuses flexibility in by fragmenting the design into three systems based on service life[3]. In addition, the necessity and available opportunities to infuse flexibility into design in order to address future expansion needs, changes in operational trends and advancements in technological and clinical practices, among others, have recently been presented by a few healthcare practitioners[4,5].

Almost all discussions on flexibility in healthcare design, however, have occurred at the overall hospital level. Flexibility issues at the inpatient unit level have not been widely published, other than those occasionally arising from clinical process challenges, such as the universal patient room[6], and distributed nurse station and supplies[7].

Understanding flexibility needs at the inpatient unit level is currently assuming considerable importance. Healthcare is going through one of the most challenging phases in history, including an ageing America[8], rising acuity levels[9], workforce shortages and ageing nurses[10,11], and staff dissatisfaction and turnover[12]. Rapid technological developments are changing patient care delivery processes. In addition, patient safety issues have emerged as a major concern[13,14]. Hospitals continually respond to such changes in internal and external factors by implementing changes in unit operational models[15].

The physical design of a setting either facilitates or impedes the implementation of such changes over the life of a hospital. Designs that impede changes can lead to expensive renovation work during the life of a facility, to the premature obsolescence of a facility or, all too often, to the development of care-giving plan that is suboptimal because it is designed around the constraints of the facility. In addition, the physical design of facilities could influence staff effectiveness[16].

From the viewpoints of efficiency, staff

Table 1. Number of respondents and departmental affiliation

Hospitals/departments	Nursing	Respiratory therapy	Materials management	Environmental services	Dietary services	Pharmacy	TOTAL
Parker Adventist Hospital, Parker CO	2	1	1	1	1	1	7
Clarian West Medical Center, Avon IN	3	1	1	1	1	1	8
Laredo Medical Center, Laredo TX	3	1	1	1	1	1	8
McKay Dee Hospital Center, Ogden UT	3	1	1	2	1	1	9
Bon Secours St Francis Hospital, Charleston SC	3	1	1	1	1	1	8
St Rose Dominican Hospital-Siena, Henderson NV	3	1	1	1	1	1	8
TOTAL	17	6	6	7	6	6	48

Table 2. Attributes of medical-surgical inpatient units included in the study

Hospital	Construction completion	Total beds	Sq ft per bed	Unit size	Unit shape	Circulation	Nursing model	Nurse: patient ratio	Universal room
Parker Adventist Hospital, Parker CO	2004	100	607	36	Irregular	Racetrack	Primary	1:5	Yes
Clarian West Medical Center, Avon IN	2005	76	700	32	Square	Racetrack	Primary	1:4	Yes
Laredo Medical Center, Laredo TX	1998	325	528	36	Pinwheel	Racetrack	Functional/ Modular	1:8	No
McKay Dee Hospital Center, Ogden UT	2002	317	673	28	Triangle/ Rectangle	Racetrack	Functional	1:5	No
Bon Secours St Francis Hospital, Charleston SC	1997	141	520	40	Square	Radial	Modified/ Modular	1:5	No
St Rose Dominican Hospital-Siena, Henderson NV	1999	214	541	34	Other	T-Shape	Functional	1:6	Yes

well-being and lifecycle cost, it is essential that the built environment supports different unit operational models over a facility's lifetime. Moreover, with a substantial proportion of the current massive investments in healthcare facilities going into bed tower constructions, (US$16-$20bn over the next decade[17]) comprehending the flexibility issues of inpatient units has wide implications and immediate practical utility.

The questions

We approached the study with an exploratory emphasis but within the adaptability, convertibility and expandability framework. It was apparent that articulating flexibility needs was contingent on the comprehension of flexibility in inpatient care. As a result, knowledge of the meaning of flexibility from the viewpoint of the different stakeholders in the care delivery process constituted a prerequisite to investigating the design implications.

We approached the problem with three main questions:

1. What does flexibility mean to different stakeholders of care delivery on inpatient care units?
2. What physical design variables do stakeholders identify as the critical dimensions of unit architecture that influence their flexibility?
3. What characteristics of inpatient care unit architecture promote or hinder flexibility?

Method

We focused on adult medical-surgical inpatient units since such units are the most common inpatient units across all hospital types and thus enhance the wider applicability of the findings of the study. The authors conducted in-depth, semi-structured interviews with management, nursing and support staff at six hospitals across the US. In total, 48 interviews were conducted. Table 1 lists the number of respondents and their departmental affiliation in each hospital. All six hospitals are new constructions, completed within the past decade. The hospitals were selected through a purposive sampling to maximise variations in physical attributes, including hospital size, unit size, unit shape, circulation type and geographical location (Table 2).

At each hospital, participation was solicited from stakeholders in patient care services, including nursing, respiratory therapy, dietary services, environmental services, materials management and pharmacy. Two research team members interviewed the volunteering participants individually for one hour on site. Interviews were conducted between September and November 2006 and guided by a plan of inquiry prepared and tested before the site visits.

The plan of inquiry included questions that addressed six main areas:

- description of a typical day on the unit by the interviewee;
- challenges the interviewee faced in conducting tasks efficiently;
- things that contributed to operating efficiency and those that the interviewee would like to change to improve efficiency;
- areas on the unit that had been changed since occupation;
- reflections on how things might change in the future and aspects of the physical design that would need to be changed; and
- the interviewee's interpretation/s of the term 'flexibility'.

The plan of inquiry was pre-tested using a combination of field testing and cognitive pre-testing methods[18].

All interviews were tape-recorded for accuracy and transcribed verbatim for subsequent analyses. Interview transcripts were subjected to content analyses[19] with three main objectives:

- to identify varying interpretations of the term 'flexibility';
- to understand the relationships between interpretations of flexibility and descriptions of functional efficiencies; and
- to identify attributes of the physical environment that facilitate or impede functional efficiencies.

Figure 1. Corner location of nurse station at Laredo Medical Center ensures enhanced peer lines of sight

What does 'flexibility' mean?

In general, stakeholders of inpatient units view flexibility purely in operational terms, while managers and administrators view flexibility at the global level of patient care management, resource allocation and response to population census. Direct caregivers view flexibility as an individual-level response to changing demands.

Most responses focused on being able to provide optimum service to patients, or to the direct caregivers, and fell within the domain of operational flexibility. Table 3 summarises the meaning different stakeholder groups attached to flexibility and the associated physical design variables.

Physical design and flexibility

Nine different flexibility needs were identified as being impacted by physical design decisions. Seven of the nine were associated with adaptability and one each was associated with convertibility and expandability.

There are some important and subtle differences between the healthcare definitions of adaptability and convertibility from those used in workplace literature.

Flexibility to adapt (or 'adaptability') is defined as the ability to adapt the environment to new circumstances, without making any change in the environment itself.

Flexibility to convert (or 'convertibility') is defined as the ability to convert the environment to new uses, with a simple and/or inexpensive alteration to the physical environment[20].

Flexibility to adapt

Data analyses suggest seven areas pertaining to adaptability that have physical design implications: peer line of sight, patient visibility, multiple division/zoning options, proximity of support, resilience to move/relocate/interchange units, ease of movement between units and departments, and multiple administrative control and service expansion options. Two concepts that did not surface in the interview transcripts were single-patient rooms and universal rooms.

Peer lines of sight

Operational issue: It is frequently envisioned that nurses work independently in providing care to their assigned patients. In contrast, the teaming of caregivers constitutes a major managerial decision. While nurses are generally assigned to a group of patients to whom they are primarily responsible, many situations in the caregiving process demand helping hands.

Teaming nurses helps optimise care during such situations – which is frequent owing to the uncertainties that characterise the healthcare environment. Teaming nurses has more than just instrumental implications. It helps develop social networks, mentoring and stress mitigation in a high-stress work environment.

A key factor influencing effective teaming is peer lines of sight. Direct visibility of peers enhances efficiency and provides a sense of safety and security for caregivers. Obstructed peer lines of sight increase stress by reducing the perceived and actual availability of help, the opportunity for mentoring and socialisation, and the potential for de-stressing. Moreover, in crisis or stressful situations, clinical staff revert to their senses rather than technology, enforcing the importance of peer visibility. Stress levels increase and perceptions of flexibility decrease when nurses feel they are operating alone. The above factors could impede or improve one's ability to be flexible to new or unique situations, and constitute an issue affecting direct caregivers. This issue was reflected in the responses of six (of 11) nurses in five hospitals and two (of six) respiratory therapists in two hospitals.

Environmental correlates: Contemporary practice in healthcare design is to shift the principal work zones of the caregiver closer to the patient by placing documentation areas and supplies storage closer to patient rooms. This is essential to minimising travel distances and increasing direct care time available to patients. However, the design of these work areas is critical to the nurses' sense of flexibility. Embedding these work areas too deeply out of the line of sight down corridors, or in areas comprising blind corners off of the racetrack of circulation, creates line-of-sight obstructions.

Of particular interest to designers is the feedback from several caregivers that the gently curving corridors, often designed to give elegant exterior form and to minimise the perception of corridor length in the interior, was an impediment to desired visibility throughout the unit.

Implications for inpatient unit design: Data suggests that several design characteristics improve peer visibility: simply-shaped unit configurations that permit as much distal visibility as possible; the corner locations of any caregiver workstations within the support core (Figure 1); and backstage corridors linking caregiver stations that may be designed within the core space.

On the other hand, several design characteristics create potential obstructions to peer lines of sight, including: double-loaded corridors of patient rooms extending off and beyond a racetrack configuration; curvilinear corridor configurations (particularly with the dramatic increase in size of today's patient rooms); charting alcoves that are so deep that sight lines are lost; and opaque support cores that obstruct visibility across a unit.

Patient visibility

Operational issue: Higher acuity in medical-surgical units is necessitating direct sensory (sight and hearing) links to patient rooms – a factor that has considerable impact on one's flexibility to multi-task. In addition, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) National Patient Safety Goal No. 6b[21] requires that nurses, respiratory therapists and other staff be able to hear equipment alarms from a satellite or central workstation. However, nursing assignment frequently involves non-contiguous patient rooms where sensory links could be potentially obstructed.

It is conventionally believed that direct patient visibility is important only in intensive care environments. However, the rise in the acuity level of today's medical-surgical inpatient population, as well as increasing efforts to reduce accidents and the risk of falls, has resulted in an imperative for the nurse to have improved visibility and auditory connection with the patient room. This includes greater visibility of the patient from the corridor. The ability to, at a minimum, see the patient room door from the main or sub-workstation provides the nurse with the proximity to hear activity in the room as well as see the patient room door. Patient visibility affects staffing efficiency as well as caregiver efficiency. This issue was reflected in the responses of 10 (of 17) nurses and nurse administrators in six hospitals, and two (of six) respiratory therapists in two hospitals.

Environmental correlates: The location of patient rooms in relation to caregiver workstations, medication stations and utility room doorways is the key physical design factor influencing patient visibility.

Implications for inpatient unit design: Data suggests that several design characteristics aid in patient visibility, including: multiple caregiver work centres with proximal patient room locations, so that shifts with fewer staff who may congregate periodically can still keep an eye (and ear) on the unit territory; unobstructed lines of sight between nurse work zones and patient room doors; and outboard location of patient room toilet/shower rooms (Figure 2).

Multiple division/zoning options

Operational issue: Optimising staffing constitutes a major component of departmental operations and a balanced and effective allocation of responsibilities remains at the heart of staffing. While it is typically believed that nurses are assigned to a set of contiguous patient rooms, in reality the assignment of patients to nurses is based on a number of objective and subjective criteria. The major considerations include the acuity level of the patient (the severity of patient's condition), the competency of a nurse, a safe nurse/patient ratio and the ability for one to have convenient access to all patients assigned. Based on balancing these criteria, the actual assignment of patients may not result in contiguous rooms.

Any perceived barriers between patient rooms may either preclude assignments or create a stressful sense of overload, leading to a set of perceived undesirable rooms. Such factors could impede the flexibility of the nurse manager to arrive at a balanced assignment of nurses to patients (or the flexibility in zoning and rezoning patient rooms in response to census) and address uncertainties in patient census. This issue was reflected in the responses of 10 (of 17) nurses and nurse administrators in five hospitals.

Environmental correlates: Among the factors contributing to perceived barriers and potentially undesirable rooms are stairwells interspersed with patient rooms, support spaces located between patient rooms and staff toilets located between patient rooms. Even smoke compartment door locations within the unit can contribute to the perception of an increase in walking distances and a decrease in visibility.

Implication for inpatient unit design: Data suggests several design characteristics that reduce perceived barriers, including stairwells or support spaces at the ends of arrays of patient rooms, and stairwells or support spaces within the support core. On the other hand, patient rooms that lie outside the primary circulation of a floor plan (for instance patient rooms located off of the main circulation in a racetrack configuration) contribute to perceived barriers, in addition to creating added walking distance to and from these areas to support spaces.

Proximity of support

Operational issue: Perceived and actual undue walking distance constitutes one of

Table 3. Summary of the meaning stakeholder groups attach to flexibility and the physical design variables affecting flexibility

Stakeholders	Flexibility meaning	Physical design variables
Management	Ability to manipulate higher-level resources (staffing, teaming) to address unique circumstances and uncertainties	Unit adjacencies; unit size; undesirable patient rooms; obstructed peer lines of sight; obstructed/inappropriate patient visibility; inter-unit circulation; degree of unit standardisation; support core convertibility; support core expandability
Direct caregivers	Ability to multi-task and multi-skill to optimise patient care, maximise efficiency and address unique situations	Obstructed peer lines of sight; obstructed/inappropriate patient visibility; inappropriate medication and supply rooms; intra-unit walking distances; inter-unit circulation; support core convertibility; support core expandability
Non-nursing staff	Ability to manipulate resources to effectively address nursing management and direct caregiver needs	Inter-unit circulation; medication, supply and utility rooms; degree of unit standardisation; support core convertibility; support core expandability

Figure 2. Bon Secours St Francis Hospital, in Charleston, South Carolina, with its unique pod design and outboard toilets, offers patient visibility through satellite nursing stations located close to the patient room

the predominant factors affecting flexibility. Undue walking distance results in higher stress and fatigue, thereby reducing one's ability to react to unusual circumstances and to be able to multi-task effectively. This issue affects both nursing and support staff. It was reflected in the responses of 12 (of 17) nurses and nurse administrators in six hospitals, four (of seven) environmental services respondents in four hospitals, two (of six) dietary services respondents in two hospitals, three (of six) materials management personnel in three hospitals, and three (of six) respiratory therapists in three hospitals.

Environmental correlates: Besides patient room to patient room circulation, a major contributor to staff walking is the distance between assigned rooms and nursing support spaces. The potential to reduce walking distance, through the provision of built-in cabinets or mobile carts in patient rooms or allowing storage capacity outside or inside the room, frequently encounters operating challenges pertaining to inventory management, control, rotation and charge capture, and re-stocking responsibility. As a result, trips to the service core for support provisions are typical in the industry.

Access to medications is yet another issue contributing to walking and fatigue. Departmental control of space, staffing and equipment costs still drive this equation. Continued centralisation of one to two rooms on a floor for medications and supplies perpetuates extensive walking distances and time in nonproductive activity. In addition, remotely located centralised storage rooms for frequently used medical equipment also contributes to increased travel distances.

Implications for inpatient unit design: Data suggests that several physical design characteristics contribute positively to flexibility by minimising walking distances. Such characteristics include: simply-shaped, possibly symmetrical units with the core location of support provisions that are as distributed as possible; association of these distributed supply areas with the caregiver work stations, whether at bedside, room-side, or team work areas in the core; and provision of decentralised room-side supply cabinets (also known as nurse servers).

Resilience to move/relocation/ interchange units

Operational issue: The ability to move services across floors or units, or both, enhances the efficiency and flexibility of operation, especially since sustained long-term census fluctuation is a rule rather than an exception. It allows the occasional shuffling of services (Figure 3) to arrive at the best fit between services and physical units. It was reflected in the responses of five (of 17) nurses and nurse administrators in three hospitals.

Environmental correlates: A standardised unit – where patient rooms as well as the support core are standardised – is a necessity before the physical design can significantly enhance the flexibility to move or relocate.

Implications for inpatient unit design: Standardisation is the reverse of customisation. As a result, standardisation to accommodate multiple types of patient populations will need additional resources during design. More importantly, standardisation should not be considered solely at the patient room level. Designs of support core change, depending on patient population type and standardisation of the support core, are essential for accommodating different patient populations over time without compromising efficiency. Standardisation should be viewed distinctly from the concept of universal rooms. A standardised unit may or may not comprise universal rooms.

Ease of movement between units and departments

Operational issue: Hospital personnel responsible for multiple units within the hospital are required to travel to several areas in a time-efficient manner. Inefficient, obstructed or long circulation routes significantly affect stress and fatigue and, thus, one's flexibility to address changing situations. This issue is more critical for ancillary caregivers, physicians, support personnel and nurse managers than the general floor nurse. The need to cross over between units is high among these stakeholders. It was reflected in the responses of four (of 11) nurses in three hospitals, two (of seven) environmental services respondents in two hospitals, two (of six) dietary services respondents in two hospitals, one (of six) materials management personnel in one hospital, two (of six) pharmacists in two hospitals and five (of six) respiratory therapists in five hospitals.

Environmental correlates: The provision of direct, easy circulation between units – vertically and horizontally – strongly facilitates flexibility.

Implications for inpatient unit design: Strong consideration should be given, in programming and design, to provide a central

circulating stair linking floors of a bed tower, regardless of whether or not it serves a life-safety egress function. It is more important to simply facilitate an easy, quick run up or down the stairs to go to another floor rather than wait on elevators for routine or Code Blue procedures. Proximal location of vertical circulation core, back corridor links between units and communicating stairs linking vertically-stacked units are examples of design that enhance flexibility.

Multiple administrative control and service expansion options

Operational issues: A frequent challenge faced by management is dealing with uncertainties. The most exemplary case of uncertainty is a sudden, unexpected and sustained increase in census, thus leading to the resizing of a service. Since uncertainties affect the match between expectations and reality, it could lead to a significant impact on job satisfaction and performance. Apparently census fluctuations in large units could exert unexpected pressure on available staff, in contrast to smaller units where it is easier to absorb additional population without adverse impact on caregivers. Across all the cases studied, census estimates – total, as well as in particular population groups – during a hospital's planning and procurement changed considerably once the facilities were occupied. As a result, services experiencing larger demand are expanded in size, frequently spreading into adjoining units. This issue could affect the flexibility of unit management in optimising staffing and was reflected in the responses of seven (of 17) nurses and administrators in five hospitals.

Environmental correlates: Space programming and design solutions for bed units that allow the floor to be subdivided in some way will contribute to more flexibility from a patient care management and administration perspective. Mixing services on a nursing floor can contribute to confusion and patient assignment challenges. The ability to identify sub-zones of care within a floor may help meet this need which is often related to fluctuations, both short- and long-term, in census with services. This concept can be addressed either in the proposed size of the basic bed unit or in design configurations that allow sub-zoning without contributing to visibility and assignment issues.

Figure 3: Standardised rooms in Clarian West Medical Center made ICU room allocation changes more economical

Designing similar unit plans in an adjacent position on the same floor appears to be highly beneficial in enhancing flexibility. However, this contiguity is only beneficial where the linkage is through a non-public corridor connection. Such an arrangement, if sufficiently close, can allow an occasional swing of patient load between the units and better support a longer-term growth in census within a specific service (Figure 4).

Implications for inpatient unit design: Design characteristics that enhance service expansion options include back corridor links between horizontally adjacent units and the ability to create sub-zones of patient services within a unit perceived by staff to be their zone (visual or geographic cues). During design, it is prudent to assess the impact of patient care services spread over multiple floors on nursing management's ability to lead and supervise as necessary.

Flexibility to convert

Within the realm of inpatient unit flexibility to convert, one issue surfaced in relation to physical design: adjustable support core elements. A frequently advocated design concept in industry literature – the acuity adaptable room[22] – did not surface in the discussions.

Adjustable support core elements

Operational issue: There is a more than occasional need for adjustment in the use of support core space arising from changes in operations, equipment and management. Supply storage room design occasionally needs re-thinking due to changes in inventory management systems and, more often, supply packaging. The size, shape and quantity of consumable goods, reprocessible items and portable medical equipment to be centrally held on a bed unit change on a regular basis. As a result, support core space demands frequent modifications. It was reflected in the responses of 13 (of 17) nurses and administrators in six hospitals, seven (of seven) environmental services respondents in six hospitals, one (of six) dietary services respondents in one hospital, five (of six) materials management personnel in five hospitals, four (of six) pharmacists in four hospitals, and four (of six) respiratory therapists in four hospitals.

Environmental correlates: Built-in cabinetry offers limited flexibility and adaptability. In fact, units intending to create more lean processes have removed doors from built-in cabinetry to eliminate door swinging. Further, with changes in equipment design over time, there is a constant need for adjusting room shapes and sizes in the support core.

Implications for inpatient unit design: In basic supply holding areas – such as clean and soiled utility rooms and equipment holding rooms – modular, moveable compartments or cart systems offer adaptability and the benefit of easy removal for thorough periodic cleaning. Similarly, for the material holding areas of medication and nourishment rooms, the same modular, moveable systems would effectively address the need. The cost of these systems compared to built-in and enclosed solutions is often considered a barrier.

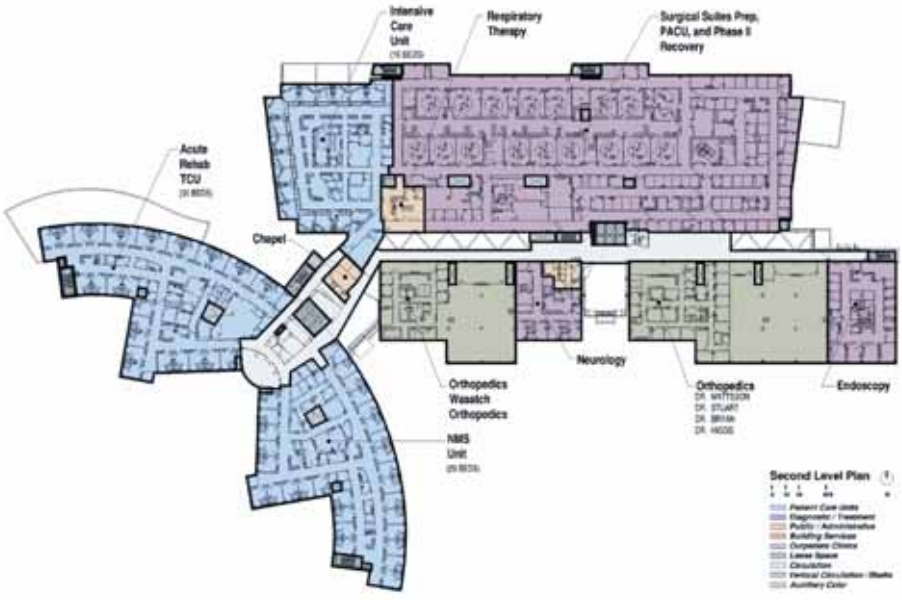


Figure 4: The layout of MacKay-Dee Hospital facilitates ease of movement between units and service expansion

However, given the modular systems' ease of responsiveness to long-term changes, this cost could be justifiable. Further, design efforts that minimise walls containing mechanical, electrical and plumbing (MEP) elements to more easily permit partition relocation should be explored.

Flexibility to expand

One issue surfaced in relation to expandability which is, nevertheless, a vital issue in enhancing long-term inpatient unit flexibility.

Expandable support core

Operational issue: Over time, operational changes demand more space in the support core – for example, when services like respiratory therapy and pharmacy are decentralised and moved to the inpatient units. The ability to expand the support core over time could considerably enhance operational efficiency over the long run. This issue was reflected in the responses of 10 (of 17) nurses and administrators in six hospitals, seven (of seven) environmental services respondents in six hospitals, one (of six) dietary services respondents in one hospital, four (of six) materials management personnel in four hospitals, three (of six) pharmacists in three hospitals, and three (of six) respiratory therapists in three hospitals.

Environmental correlates: The availability of space to expand support core functions adjacent or close to the unit is warranted for long-term flexibility. In the short run, it could take the form of a hotel-type unassigned space on each floor of the unit. This space offers two distinct points of flexibility. First, it can accommodate a specialty support function associated with the clinical service assigned to that floor – for example, a physical therapy satellite for an orthopaedic unit or a satellite pharmacy area on an oncology unit. Second, it can serve as an equipment or technology garage to centrally hold many of the necessary support tools used infrequently on today's inpatient care units, such as bariatric chairs or beds or patient lifts. In the long-term, areas in the support core needing additional space could replace the hotel-type function.

Implications for inpatient unit design: In response to the need for expansion, the following considerations could help enhance unit flexibility:

- designing adjoining spaces that can serve as an extension of support core space, which is highly useful for shared support elements between units (Figure 4); and
- provision of a 'loose' programme approach of unassigned space which will typically find an appropriate use before schematic design is complete.

Care should be taken to ensure adherence to the real storage needs on inpatient floors when budgets get tight and space is cut. A balance between bed numbers and storage space must be maintained to make certain that the resultant design offers the required storage space for equipment. Better anticipation and programming for the inevitability of service and operational changes could help in promoting a flexible unit design.

Discussion

The most noteworthy aspect of the findings pertains to the differences in the number of operational issues related to the three facets of flexibility at the inpatient unit level. Specifically, seven of the nine flexibility issues relate to adaptability, far outnumbering the operational issues affected by the flexibility to convert and expand. In contrast, previous healthcare and workplace literature has predominantly focused on expandability and convertibility – and a vast majority of flexibility considerations during hospital design also occurs in the realm of expandability and convertibility. Our findings suggest that the nature of flexibility required could change depending on the specific setting. In addition, adaptability considerations for inpatient care units should be accorded higher, or at least equal, priority to expandability and convertibility.

As a result, for designers of inpatient units, adaptability is a vital area to ensure short- and long-term operational efficiency (without de-emphasising the importance of support core convertibility and expandability). Data analyses suggest that physical design plays a crucial role in facilitating or impeding the ability of organisations and their personnel to adapt to changing workload demands, staffing patterns and operational challenges. Adaptability is also crucial to long-term flexibility in inpatient care. Irrespective of changes in technology, operational design, philosophy of service and models of care, several things will remain constant over time in care-giving. Patient care will be primarily given by one or more nursing staff to a patient; some form of a care-giving team will be assigned a group of patients; and maximising time spent at the bedside in direct patient care activities will be a high priority for design. It is also likely, regardless of advances in technologies and care delivery models (such as video monitoring and eICUs), that geographic zoning of the inpatient care unit will continue to be an operational consideration, in order to find a best-practice balance between cost of space, equipment, support human resources for care and the

maximisation of direct care by the nurse.

What may change is the way support services, such as medication, supply and food, are delivered to care-giving teams; how sanitation and infection control standards are met; how all forms of communication are facilitated between all parties to the care experience; and how non-patient parties are assimilated into the care plan and care environment. Considering the projected shortage of trained nurses, as well as other allied caregiver personnel, it is possible that the need for care-giving staff to be multi-skilled and able to be flexible and adapt to changing situations and demands may increase over the next decades. From such a perspective, adaptability assumes considerable importance in the short as well as the long term.

The primary emphasis of this study was to articulate the flexibility needs of care-giving staff to designers, as well as to address ways to enhance the ability of the physical environment to support the functional needs of caregivers over the long run. This study constitutes a preliminary but important step in that direction.

This study is essentially exploratory in nature and, hence, should be considered with an appropriate understanding of these limitations. Consistent with most qualitative study designs, the sample size was intentionally kept small. Future studies should consider expanding the sample for greater generalisability, as well as more explanatory assessments of design characteristics and flexibility in inpatient care units, based on the findings from this study. In addition, bed unit operations are not entirely insulated from the flexibility needs of the rest of the hospital. Future studies could and should begin to link micro and macro flexibility needs and the design issues arising out of such needs. Nevertheless, this paper constitutes a unique and important contribution to our understanding of flexibility in architectural design for inpatient care units.

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Authors

Debajyoti Pati, PhD, FIIA, LEED AP is director of research at HKS Architects.

Thomas E Harvey Jr, AIA, MPH, FACHA, LEED AP is senior vice president of HKS Architects.

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Dementia Care:
Determining an environmental audit tool for dementia-specific research

A critical examination of the validity of a range of auditing tools for their effectiveness in assessing the physical environment of dementia facilities

Ian Forbes, Richard Fleming

This study was undertaken in parallel to a major dementia study and was used to determine the validity of a tool for auditing the physical environment in dementia facilities. The major research project is titled *Person-centred Environment and Care for Residents with Dementia: a cost-effective way of improving quality of life and quality of care*? With a working title of 'PerCen Study', the project was approved for three years' funding by the Australian National Health and Medical Research Council.

The team was predominantly from the University of Technology Sydney, but with participation also from the Universities of Sydney, New South Wales, Wollongong and the Australian National University. The project was based on previous work in both person-centred care and person-centred design by the researchers involved. They were:

a. Dr Lynn Chenoweth, Prof Henry Brodaty, Prof Madeleine King, Dr Yun-Hee Jeon and Prof Jane Stein-Parbury, who tested the efficacy of person-centred care in improving care delivery for aged care residents with dementia, staff's attitudes and approaches to care, and improving the health and well-being of the residents;

b. Chanel Burke, Dr Lynn Chenoweth, Dr Yun-Hee Jeon, and Prof Jane Stein-Parbury, who are developing and validating a person-centred measure of the dementia care environment and care delivery;

c. Richard Fleming and Prof Ian Forbes, researching the identification of the essential principles in designing environments that help maintain the abilities of people with dementia and make for more effective care delivery;

d. Richard Fleming, who has developed a validated measure of the person with dementia's emotional responses as an indicator of quality of care; and

e. Dr Victoria Traynor and Chanel Burke who are undertaking dementia nursing care competency research.

Residents enjoy tea and cakes at the Bangalor Retreat aged care facility in Tweed Heads, NSW

The aims of the PerCen Study were to determine: the effect of providing person-centred care (PCC) on the quality of life (QOL) and quality of care (QOC) of aged care residents with dementia; the effect of modifying the physical dementia care environment (person-centred environment design (PCD)) on the QOL and QOC of aged care residents with dementia; the combined effect of PCC and PCD on resident QOL and QOC; the effect of PCC on quality of care for residents with dementia; and the costs of PCD and PCC, and undertake an economic evaluation.

Justification for the project

The progressive nature of dementia leads to a significant reduction in capacity for self-care and self-determination, which are essential features of QOL. Kitwood's social-psychological theory of personhood[1] challenges the notion that dementia must inevitably be characterised by decline, disintegration and despair, even though there is continuing decline in brain function. The theory posits that ill-being, or poor QOL, may result from negative contextual stimuli, including physical environments that lack cues to orient the person to their present reality, and care practices that disregard 'personhood' by denying opportunities for making choices and decisions[1,2].

An important aspect of this study is the ability to determine the effects of the PCD interventions in comparison with, and separate from, the effects of PCC. Usually such research is not able to distinguish the effect of the environment from changes in staff interventions[3].

Person-centred care is distinguished by care staff making genuine efforts to understand and meet the person's individual needs. This means ensuring they gain a sense of place and belonging and providing emotional and physical security.

Personhood is achieved when staff respect the person's individuality, make contact with the person in order to understand their present world and give them recognition, respect and trust[4,5,6]. Thus PCC improves the person's QOL by helping them to feel valued for who they are, rather than being known for their disease.

Kitwood suggests that evidence of PCC is through a decrease in their ill-being and psychological symptoms of dementia, such as agitation, aggression and perseveration experienced by the person with dementia, and an increase in their well-being and QOL[1,2]. The study will identify if this is the case in sites where PCC and PCD are introduced.

There are direct links between QOL for persons with dementia and physical space[7], whereby the physical environment serves as a non-pharmacological supportive element in retaining memory[8,9], stimulating the remaining senses, enabling communication with carers, assisting the person to retain self-control[10,11] and reducing levels of anxiety, aggression, depression and psychotic behaviour, through built 'cues'[12,13,14]. PCD environments improve or slow the decline in residents' communication skills, self-care skills, social function, mobility and affective responses[8,15].

The physical environment can, therefore, exercise dramatic psychological impact on QOL for the person with dementia as they lose the capacity to achieve the human needs of comfort and familiarity – for example, recognition of familiar objects helps the person to understand the sensory input they get and helps provide a sense of place[16]. The study will identify if PCD indeed supports both QOL and QOC.

Research methods

It was determined that a factorial group-randomised cohort study with stratification was the only feasible design. Because we were interested in the main effects of PCC and PCD, individually and jointly, we determined to use a factorial design. Previous studies indicated considerable correlation within individuals over time (range 0.6-0.7), so a cohort design (pre-test, post-test and follow-up) would increase the power of the design. Stratification would be used to ensure balance across treatment groups in geographical locales and by type of facility (private for profit, private not for profit); this would allow us to test whether the effects of PCC and PCD differ across strata, which is an important issue for facilities development. Residential aged-care sites that show minimal (less than 15%) evidence of providing PCC or PCD at baseline would be randomised to one of four treatment groups. In addition, the two treatment factors would each have two levels.

Table 1
Conversion of PCECAT scores to RFI scores

Table 1	
PCECAT	**RFI**
0 = Not even considered	3 = A lot of room for improvement
1= Have thought about	2 = Quite a bit of room for improvement
2 = Sometimes used	1 = Some room for improvement
3 = Used a great deal	0 = No room for improvement
4 = Fully implemented	0 = No room for improvement

Person-centred care (PCC) Level 1: person-centred care delivery according to Kitwood's care principles (PCC)[1]; and Level 2: usual (non-person-centred) care (UC).

Environmental design (PCD) Level 1: adjustments to spatial configurations employing Kitwood's principles[1] for person-centred dementia environment design (PCD); and Level 2: usual (non-person-centred) dementia environment design (UD).

The factorial design would give four treatment groups: PCD+UC, PCD+PCC, UD+PCC, and UD+UC as the control group. Ten sites have now been allocated at random to each group. Stratified random sampling was used to ensure an equal distribution across the four treatment groups by geographical location and by type: private for profit, private not for profit. In Australia, public funding for eligible aged care recipients is delivered primarily through private providers. Residents with dementia, their nominated proxy (frequently visiting family/friend) and care staff were recruited from these 40 care sites. The essential elements of the two aspects of the study are outlined below.

Due to limited funds within the grant, only minor modifications to the environment in each of the 20 sites would be undertaken to reduce the worst of the physical environmental effects.

Facility selection

In order to reduce the number of facilities that volunteered – from 64 to the 40 needed for randomisation – an evaluation instrument was chosen that combined both person-centred care and person-centred environments having both elements scored in the same evaluation. This was called the Person-Centred Environment and Care Assessment Tool (PCECAT). This tool was not sufficiently robust to undertake the assessments for determining the PCD interventions at the assigned aged-care facilities, but was useful for this initial selection. The PCECAT was developed independently by researcher Chanel Burke as a self-assessment evaluation instrument to assist managers and staff of residential aged care homes to conduct evaluations of care practices and the supportiveness of the environment in a home.

With respect to the PerCen Study, the initial overall evaluation of the facilities was intended to provide a single ranked score covering both aspects (PCC/PCD) for each facility in order to determine which facilities were already well advanced with implementing PCC or had sufficiently supportive environments. It was our intention to eliminate the best and retain the worst of the facilities as the interventions were hypothesised to improve these poor situations.

The PCECAT consists of three sections:

Section A: characteristics of the home that address information relating to the main features of the home.

Section B: the three domains which assess care practices and the environment of the home. These domains include: organisational culture (Domain 1); care, activities /interaction/ relationships and interactions (Domain 2); and the physical layout and design of the home (Domain 3).

Section C: an opportunity to use the tool as a means for staff to develop strategies to improve care practices and the environment.

The domains in the tool were based on a set of guiding principals that met the requirements of the Australian Accreditation Standards identified for that specific domain[17].

Each of the 64 facilities was assessed according to the PCECAT tool. The scoring used in the tool rated the extent of having

begun implementing PCC and PCD at each facility. This score required five values for the issues under consideration, from 0 (not even considered) to 4 (fully implemented). On receiving the results, it was difficult to determine at the margin which facilities should be eliminated, based on whether there was any room for improvement and therefore worthy of inclusion. To assist with this decision, the ratings of PCECAT was modified to a rating which identified room for improvement (RFI) scores (see Table 1).

The result generated 38 units poor enough to include as they had sufficient room for improvement. It then required the inclusion and assessment, using RFI, of additional facilities from the reserve list to provide the 40 facilities needed for randomisation.

Evaluating audit tools

Once the randomisation had been completed, the PCD evaluation of all 40 facilities could be undertaken to establish a base condition prior to interventions in 20 of the aged-care homes. In selecting a tool for measuring what interventional changes would be necessary in a facility, an examination of the various tools used internationally was conducted.

In 2006, Cutler, Kane *et al*, undertook a similar study of 1,988 nursing homes in the US and developed a tool to do this work[18]. It was felt, however, that this instrument was too broad for our purposes as it included many aspects of nursing homes that would not be suitable for dementia-specific units and had different objectives in its measurements. However, similar to their study, we also assessed the three tools most internationally recognised for nursing home assessments that include dementia-specific units.

The tools examined were the Multiphasic Environmental Assessment Procedure (MEAP)[19], the Therapeutic Environmental Screening Scale (TESS+)[20,21] and the Professional Environmental Assessment Protocol (PEAP)[22].

The Cutler and Kane review[18] showed that the MEAP was a most comprehensive instrument consisting of a battery of five major rating instruments, each with subcomponents covering the broadest definition of environment. While the MEAP has been described as "the most established instrument"[21], it has only one component dedicated to physical and architectural features dealing with the physical environment. The scales of this component were designed to assess planned residential environments for older people, ranging from congregate housing to nursing homes. The objectives of the PerCen Study were much narrower and intended to cover a smaller residential unit for people living with dementia.

While MEAP does partly cover this aspect, it is a very detailed assessment which is not suitable for use by non-researchers, its scoring was considered biased toward larger, more institutional settings[19] and it does not include aspects of the physical environment in dementia-specific facilities considered by the PerCen Study team to be essential. In addition, a literature review showed it now appears to have fallen into disuse in dementia-specific research and doesn't reflect current research in dementia care – so, it was rejected.

Many of the issues of MEAP were addressed in the Therapeutic Environmental Screening Survey (TESS-NH)[21] being the latest version of the instrument after several modifications. The modifications had come about because the original 12-item instrument (TESS) developed in the late 1980s for briefly screening nursing home special care units used for Alzheimer's disease, became the TESS+2 adjusted for use in the American National Institute on Aging project for the evaluation of special care units (NIA SCU) that commenced in 1991. It was as a result of the NIA study that adjustments occurred to become the TESS-NH, previously called a 'scale' but now called a 'survey'.

The TESS+2 was created to address six consensus goals used to evaluate the physical environments in long-term care facilities while the environment was to be assessed under eight environmental domains[20]. The modifications that produced the TESS-NH included condensing categories where 85% of responses fell into a single-response option, essentially because of the lack of their variability and those options with fewer than 5% responses were simplified[21]. Importantly, embedded within the TESS-NH is the selection of 18 item scores into a special care unit environmental quality scale (SCUEQS). The SCUEQS consists of scores that were demonstrated to have the following properties in the NIA SCU studies: a correlation above 0.20 with global ratings of environmental quality by project data collectors; adequate inter-rater reliability; and adequate item variability.

This current TESS-NH scale now contains a series of 13 domains of discrete items including one item that covers all domains. Scoring is required for each item in the domain, many are dichotomous scores for yes or no and others have gradation with 0 (none) to 3 (most acceptable). Only the thirteenth domain, covering an opinion of the overall physical environment, has a Likert scale with a low score of 1 and a high score of 10.

In addition to TESS-NH the Professional Environmental Assessment Protocol[22] was evaluated. The PEAP consists of a five-point rating of nine dimensions, each of which represents a desired outcome of 'quality' environments. Each dimension is defined, with an expanded conceptual discussion of its meaning, followed by a rater's guide as to what to observe and inquire about at the time of the walk-through. In terms of its application, the time taken to complete the PEAP during a validation study was 45-90 minutes. However it has also been described as requiring a 'several-hour visit' for completion[21].

The relationship between the PEAP and an earlier version of the TESS was shown to be strong, with a correlation of 0.55 between the PEAP total scores and the SCUEQS and a multiple correlation of 0.89 between all TESS items and the PEAP total score[22]. The correlation between the TESS-NH and the PEAP was found to be similar[23]. When SCUEQS scores were compared with independently conducted expert assessments using the PEAP in 44 SCUs, the correlation between the global PEAP assessment (a five-point scale) and the SCUEQS was moderately strong ($r=0.52$, $p<0.01$), and the correlation between the global PEAP scores and the TESS-NH global rating item was very strong ($r=0.68$, $p<0.01$).

In considering our uses for the tools, the PEAP requires a sophisticated and experienced rater able to devote a considerable amount of time to the assessment. The TESS-NH yields results that correlate well with the PEAP, takes half the time and can be used by a research assistant after eight hours of training[21]. So the TESS-NH has a practical edge over the PEAP.

However, the TESS-NH has some severe limitations. While the 84 items cover a wide variety of relevant environmental features,

The Amity Aged Care facility at Sutherland Hospital in Sydney

they do not combine to form a single scale and therefore do not enable a simple summary of the quality of the environment to be obtained. This is left to a single item with a global rating scale within TESS-NH. It was felt that such a simplistic approach on one scale was not useable when compared to the other systems with accumulated scores, and similarly with the much less than comprehensive SCUEQS.

The SCUEQS score does tell us a little more by ensuring that equal weight is given to a comprehensible number of defined items. However of the 18 SCUEQS items, four deal with maintenance matters, three with cleanliness and two with odour from bodily excretions, i.e. 50% of the scale is of dubious relevance to the specific care of people with dementia as it is understood in the Australian context[12] or as described by the accumulated research evidence described above.

An alternative scale

The question then arises as to whether or not there are assessments better suited to understanding environments for people with dementia than is current in Australia. In order to consider an alternative scale it would need to meet similar criteria to be considered more appropriate than the TESS-NH.

A tool selected to compare with TESS-NH was the most recent version of the Environmental Audit Tool (EAT) developed in a NSW Department of Health project on adapting wards in small, regional hospitals for long term use by people with dementia[14]. The EAT comprises 72 items that have been selected to exemplify a set of design principles first used in the development of the units for the confused and disturbed elderly (CADE) built by the NSW Department of Health in the late 1980s and early 1990s[24,25]. This scale was extended, as described in the Department's *Adapting the Ward* manual[14]. The items are grouped by the 10 principles in which the environment should:

1. Be safe and secure
2. Be small
3. Be simple with good visual access
4. Have unnecessary stimulation reduced
5. Have helpful stimuli highlighted
6. Provide for planned wandering
7. Be familiar
8. Provide opportunities for a range of private to communal social interactions
9. Encourage links with the community
10. Be domestic in nature, providing opportunities for engagement in the ordinary tasks of daily living

In this tool the items are not uniformly spread across the groups. The principle of smallness is covered by a single question on size while the largest group of questions (14) deals with safety and security features. The majority of questions are answered either 'yes' or 'no'; some have a 'not applicable' option; and some provide for extra points in certain circumstances, for example, if the safety feature is unobtrusive. Each principle is considered to be a subscale with a score expressed as a percentage of the available score to ensure that all subscales have equal weight. The total score is the mean of the subscale scores.

Comparing EAT with TESS-NH

In order to compare the characteristics of the two scales, a separate study in parallel to the PerCen Study was undertaken specifically to validate the EAT scale using a sub-sample of the facilities involved in PerCen. In doing this a sample size of 30 facilities was considered to be adequate, on the assumption that the inter-rater reliability of the EAT would be close to that obtained with the SCUEQS, i.e. an ICC of 0.9321.

The appropriate sample size was initially determined by reference to the graph provided by Streiner and Norman[26] and later checked by the application of the formula provided by Walter to optimise the number of observations required in inter-rater reliability studies[27]. This indicated that a sample of 18 would be sufficient at a power of 80% with an expected ICC of 0.93. The sample of 30 facilities therefore provided a safety margin in case the inter-rater reliability of the new tool

External view of Bangalor Retreat aged care facility in Tweed Heads, NSW

was lower than that of the TESS-NH.

Two raters were employed for the observations. One had many years of experience as a consultant on the care of people with dementia and had been involved in many design exercises. The other was a first-year PhD candidate with a degree in psychology. They were provided with the three assessments and supporting manuals and spent three hours reading them and in discussion with one author. They then assessed two facilities not included in the sample in collaboration, discussing the interpretation of questions and the method for completing the tools. The results of these assessments were fed back and there were few disagreements. Where there were disagreements these were discussed with the author and a consensus determined. The training process took approximately eight hours.

The raters then visited the sample of 30 facilities over a period of six weeks. The order of assessments was varied at each visit to control for the contamination of one assessment tool by the provision of information from another tool. The raters worked independently in each facility, helped by a staff member who identified the boundaries of the unit and provided them with access to the required areas. The completion of the three assessments took between 1.5 and 2.5 hours.

The six-week period included a break for Christmas. The raters refreshed their memory of the instructions for the assessments by re-reading the manuals after the break.

Data were entered into SPSS 17 for analysis. The level of inter-rater reliability was calculated using the intra-class correlation coefficient for both categorical and quantitative data following the recommendations of Fleiss and Cohen[28] who found that the ICC and weighted kappa are equivalent. The ICCs reported here are therefore comparable to the weighted kappas reported in the TESS-NH validation study[21].

Results

The reports on the previous studies[21] on the validity of the TESS-NH, shows the average percentage of agreement between two raters was 86.7 (range 41.7% to 100%). Pearson correlation coefficients for continuous variables ranged from 0.33 to 1.0; kappas ranged from 0.13 to 1.0; seven items had kappas less than .40; and the majority (two-thirds) were greater than 0.70. The inter-rater reliability of the SCUEQS was 0.93. Cronbach's alpha was not calculable for five of the sub-groupings; two of Cronbach's alphas were below the usually accepted level of 0.6 and five were above.

In the present study using the TESS-NH, the average percentage of absolute agreement between the two raters was 84.4% (range 43% to 100%). Pearson correlation coefficients ranged from -0.11 to 1.0. Three items (doors to rest of facility disguised, cleanliness of social spaces and visibility of signs from resident rooms) had negative correlations; however the latter is a dichotomous variable. ICCs ranged from -0.07 to 1; 18.1% of items had ICCs of less than 0.4 and 39.8% of the ICCs were greater than 0.70. The inter-rater reliability of the SCUEQS was 0.84. Four of the subscales have a Cronbach's alpha below the usually acceptable level of 0.6, two were not calculable and seven were above the acceptable level.

The average percentage of absolute agreement between the two raters using the EAT was 80.2% (range 53% to 90%). Pearson correlation coefficients ranged from -0.05 to 1.0. One item (artificial lighting bright enough) had a negative correlation. ICCs ranged from -0.05 to 1; 13.8% of items had ICCs of less than 0.4 and 54.2% of the ICCs were greater than 0.70. The inter-rater reliability of the total score was 0.97. Two of the subscales ('highlighting of helpful stimulation' and 'familiarity') have a Cronbach's alpha below the usually acceptable level of 0.629.

Conclusion

The TESS-NH was developed in the US in the early 1990s before much of the useful literature on environmental design was published. It reflects a rather institutional approach to the residential care of people with dementia and does not capture the person-centred, small-scale, domestic philosophy of care that has informed developments in Australia and the UK[30]. The EAT has been developed within that philosophy and informed by the recent literature. However, their currency and relevance does not guarantee their psychometric qualities.

The item-by-item inter-rater reliabilities of the scales are very similar. The average level of absolute agreement between raters across all items is 84.4% (TESS-NH) and 80.2% (EAT). The inclusion of a 'not applicable' category in many of the EAT questions appears to have reduced the maximum level of absolute agreement to 90% by providing a rater with the opportunity to opt out of making a judgement rather than forcing a judgement to be made. On the other hand, it may have contributed to the EAT having the highest minimum level of absolute agreement (53%) against 43% for the other scale.

The intra-class correlation coefficient of the items has a greater spread with 39.8% of TESS-NH items having an ICC in excess of 0.7, and 54.2% of EAT items. It must be noted that the Australian TESS-NH raters did not achieve the same level of agreement as the original TESS-NH raters in that the originals achieved kappa scores in excess of 0.7 for two-thirds of the items.

In all scales there were instances of negative correlations (three in TESS-NH, and one in EAT). Whether this was due to a disagreement about the meaning of the questions or differences in conclusions based on observation is not known. It should be noted that the original TESS-NH ratings included one with a zero correlation. Neither of the scales achieved the desired standard of having all of the subscales reach the benchmark of internal consistency, i.e. a Cronbach's alpha of 0.6. Seven of the 13 TESS-NH scales achieved this and eight of the 10 EAT scales. The low Cronbach's alphas in the 'highlighting of helpful stimulation' and the 'familiarity' subscales of the EAT have been improved by eliminating items that have zero variance or low correlations (0.2 or below) with the subscale totals. This reduced the 'highlighting' scale to five items with a Cronbach's alpha of 0.6 and the 'familiarity' scale to three items with an alpha of 0.62. All subscales in the EAT now have acceptable internal consistency.

In the final analysis the EAT audit tool, as adjusted, provides an acceptable alternative to the TESS-NH that is quick and easy to use, valid and reliable and arguably a better measuring instrument. It also reflects the current environmental requirements described in the international literature for dementia residences. For the PerCen Study it promises to provide a tool capable of determining the interventional requirements for each facility and an understanding of what interventions are likely to achieve when improving person-centred environment design – an important objective of the study.

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Authors

Ian Forbes is director of health at DesignInc Architects and adjunct professor, Faculty of Design, Architecture and Building at the University of Technology Sydney.

Richard Fleming is director of the Dementia Services Development Centre, HammondCare and clinical associate professor, Faculty of Health and Behavioural Sciences at the University of Wollongong.

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Critical Care Units: **Trends in winning designs**

This study compares key trends in the design of the award-winning critical care units over the 17-year history of the annual Society of Critical Care Medicine design competition

Charles D Cadenhead, FAIA, FACHA
Diana C Anderson, MD, MArch

The objective of this study was to discover the themes that correlate with therapeutic and supportive environments, as judged by physicians, nurses and architects.

The rich information available from the annual Society of Critical Care Medicine (SCCM) design competition was utilised to perform a comparative data analysis contributing to evidence-based data. This analysis describes programme, architectural planning and trends in highly respected intensive care unit (ICU) designs.

The Society of Critical Care Medicine is the largest international multi-professional organisation dedicated to ensuring excellence and consistency in the practice of critical care[1]. Its annual design competition has been co-sponsored since 1992 by the SCCM, the American Association of Critical Care Nurses (AACN) and the American Institute of Architects/Academy of Architecture for Health (AIA/AAH). The winning entries constitute some of the best-practice examples of ICU design within the USA and Canada.

Submission requirements

All types of critical care units are eligible for entry into the design competition, including paediatric, neonatal, adult care units and those of various medical subspecialties.

All competition entries are accompanied by a set of forms completed by each submitting ICU. This information provides background data for those judging the entries related to design approach and concept, construction budgets, type(s) of patients cared for, overall size of the units and also includes a small-scale floor plan of the unit.

In addition, each ICU provides a video walk-through with a voiceover description of the unit illustrating the attributes staff feel are especially important. This entry information was established for the first competition in 1992 and has been continually received from the submittals since.

To date, the competition has seen only North American entries. As such, most submittals have followed the *Guidelines for Design and Construction of Healthcare Facilities*, published by the Facility Guidelines Institute and the AIA/AAH[2]. However, future entries may include international submissions, no doubt providing interesting comparisons among ICU designs worldwide.

The judging is performed by several groups geographically dispersed around the US, occurring on scheduled dates in the autumn, all within a few days of each other. Standard forms are used to facilitate the judging and ranking of entries and include numerical scores for design characteristics under the following categories: environmental qualities (including colour, light, layout, noise, amenities, etc) and overall features (including size, functionality, safety, security, technology, etc).

In any given year, one or more winning ICU design(s) may, or may not, be selected by voting teams. To date, 1994 was the only year in which no winning entry was selected.

Sample size

This study included 12 adult ICUs built between 1990 and 2007 (Table 1). Each had received an SCCM ICU design award

Table 1. Programmatic analysis overview of best practice critical care units

Best-Practice ICU Area Analysis		ICU Beds	Departmental Areas		Departmental Areas/Bed		Patient Room Areas	
			DGSF	DGSM	DGSF/Bed	DGSM/Bed	NSF	NSM
1992	The Swedish Medical Center	32	29,615	2,751	925	86	255	24
1993	East Jefferson General Hospital	20	17,549	1,630	877	82	263	24
1996	Legacy Good Samaritan	28	28,713	2,668	1025	95	256	24
1997	Southeast Missouri Hospital	12	11,418	1,061	952	88	271	25
2000	Clarian Health Group Methodist Hospital	56	23,494	2,183	839	78	353	33
2001	St. Joseph's Health Center	16	17,107	1,589	1069	99	321	30
2003	Harris Methodist Fort Worth Hospital	20	14,802	1,375	740	69	223	20
2003	McGill University Health Center	26	17,002	1,580	654	61	189	18
2005	The Queen's Medical Center	40	29,277	2,720	732	68	240	22
2006	Sharp Grossmont Hospital	24	21,271	1,976	890	83	256	24
2008	Emory University Hospital	20	21,080	1,958	1054	98	352	33
2009	Memorial Sloan Kettering Cancer Center	20	21,478	1,995	1074	100	236	22

Pt Rm NSF/NSM = Patient Room Net Square Footage/Square Meters
DGSF/DGSM = Departmental Gross Square Footage/Square Meters (includes rooms, circulation, interior partitions; does not include stairs, elevators, mechanical spaces, exterior walls)

and 10 of the units were included in the ICU design CD-ROM and DVD published by the competition's three co-sponsoring organisations. Honourable mention award winners were not included. The most recent two winning entries from 2008 and 2009 were analysed based on their competition submittal package, digital floor plans and tours by the author, as an updated ICU design CD-ROM and DVD package is currently underway.

For consistency of unit-type programme, all winning paediatric (1995, 2005, 2007) and neonatal ICUs (1995, 1999, 2002, 2004) were excluded from this analysis and only adult units were studied. In addition, one award-winning adult ICU built during this period, the 1998 winning design, was excluded from the study due to inadequate information for proper analysis.

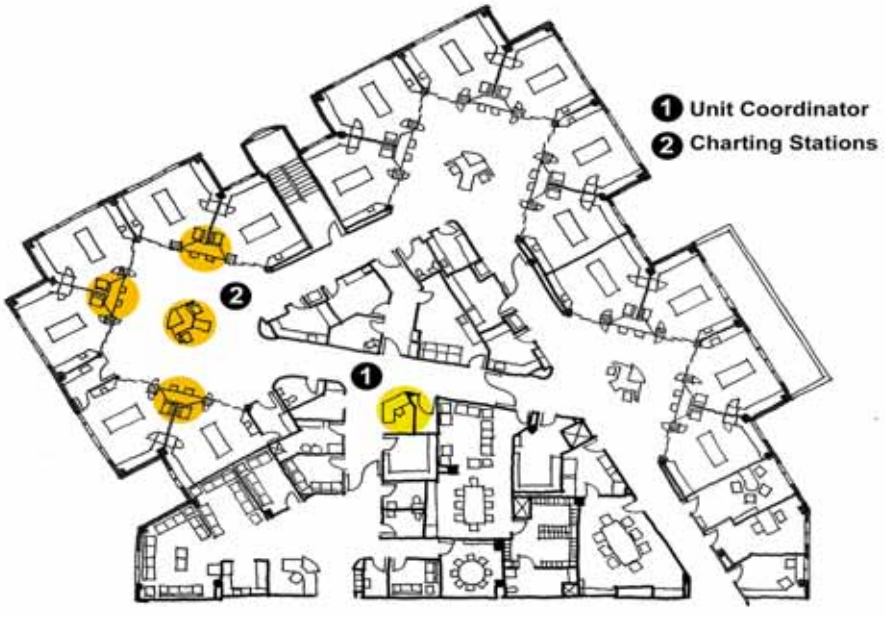


Figure 1: Pod design incorporating fully decentralised charting model at St Joseph's Health Center ICU (Illustration: Diana Anderson MD, MArch)

Methodology

Each of the winning units in the selected sample underwent a room-by-room area analysis of the floor plan to document the detailed functional programme, net square footage/metres (NSF/NSM) of each room, departmental gross square footage/metres (DGSF/DGSM) and building gross square footage/metres (BGSF/BGSM) of each unit. Unit departmental areas per bed (DGSF/DGSM per bed) were calculated for each unit and an overall comparison done. A study of net-to-departmental grossing factors was also undertaken. Protocol for the area take-offs was based on the 2008 *Analysis of Departmental Area in Contemporary Hospitals: Calculation Methodologies & Design Factors in Major Patient Care Departments*, ensuring a consistent and pre-validated method of area analysis[3].

Additional design characteristics unique to each ICU were obtained by floorplan review and from the submittal materials and video and documented in a spreadsheet format. Each spreadsheet consisted of three overall categories, including basic submittal information (unit type, bed count, new construction, renovation, etc), programmatic and design characteristics (unit design, patient room design, nursing design, etc) and a room-by-room space programme summary.

The authors have had the opportunity to visit five of the twelve winning designs, providing interesting 'lessons learned' that are not so obvious from the entry information and present the occasion to see units several years after opening and observe how they have fared.

Data analysis

The design competition entry data, information collected through post-occupancy tours and architectural plan analysis have yielded interesting comparisons of past SCCM ICU winning designs. The findings compare and contrast planning approach and concept, space programme components and areas, social organisation of the unit, architectural layout, configurations and circulation patterns.

Construction types: A greater number of newly built ICUs, as opposed to renovation projects, were found in the sample. Among the 12 units, seven are new construction, three are renovation and two mixed (new construction and renovation).

Functional types: A typology of adult ICUs often includes the following medical specialties: medical ICU, surgical ICU, neurological ICU, coronary care unit (CCU), respiratory ICU, burns ICU and mixed-service ICU[4]. According to this survey, six of the 12 units provide mixed critical care services. The remaining units provide specialised services.

Layout types: Rashid presents an analysis of the physical design characteristics of a set of ICUs which include a number of the SCCM best-practice examples[4]. His research indicates that, "the layout of an ICU is arguably the most important design feature affecting all aspects of intensive care services including patient privacy, comfort and safety, staff working conditions and family integration". In general, no single ICU geometry has been found to be clearly superior over another. There appears to be a wide consensus that patient room size and unit comprehensive scale and programme more effectively impact healing. Layout generally determines the location, configuration and relationship between different spaces within a unit, and possible sharing of space and functions.

The largest number of units utilised the pod concept of decentralisation with varying bed numbers ranging from 4-8 beds per pod. One of the units demonstrates a more linear configuration, while three present pure racetrack configurations. 'Racetrack' implies service in the centre and patient beds on the perimeter with a loop corridor space in between. The pod arrangement, for beds and support spaces, appears to be a frequently employed concept among winning designs, likely for ease of patient monitoring and decreased walking distances by staff. However, few of the units are purely one layout, with several including characteristics of multiple layout types.

Unit circulation: The designation of space for circulation appears to have moved towards an on-stage/off-stage model in more

Table 2: Average net to departmental area grossing factors by construction type

Average Net to Departmental Area Grossing Factors			
Construction Type	**Grossing Factors**	**Range**	**Avg Factors**
New Construction	1.37 - 1.67	0.30	1.57
New & Renovation Construction (Mixed)	1.59 - 1.70	0.11	1.65
Renovation Construction	1.63 - 1.74	0.11	1.69

Table 3: Program categories used during area take-off analysis of best-practice ICU designs & percentages of total department area

ICU Program Components & Percentage of Departmental Area			
	Percentage Range	**Variance**	**Average**
1 **Patient Care** — Includes the patient room and patient toilet room	38.6 - 68.1%	29.5%	48.0%
2 **Staff & Material Support** — Includes centralized & decent charting, clean & soiled, etc.	15.1 - 32.0%	16.9%	23.0%
3 **Staff Facilities** — Includes staff lounge, lockers, toilets, on-call rooms, etc.	3.0 - 9.1%	6.1%	6.0%
4 **Diagnostic & Therapeutic** — Includes imaging suites, dialysis, pharmacy, lab, etc.	0.0% - 8.1%	8.1%	2.0%
5 **Administration & Education** — Includes classrooms, conference spaces, offices, etc.	2.8 - 24.2%	21.4%	9.0%
6 **Public & Family** — Includes waiting areas, family sleep rooms, amenities, etc.	5.7 - 25.2%	19.5%	12.0%

recent years and certainly in the three most recent winning entries. It must be noted that incorporating multiple circulation routes adds to the overall departmental area of an ICU, thus increasing the departmental grossing factor and costs associated with the design and construction of units. However, cost and space allowing, this notion of separate paths of movement and circulation will likely continue to be a tendency seen in future critical care designs.

Area take-off analysis: An area take-off analysis of spaces within each unit was undertaken in order to fully understand design trends and programmes within the critical care environment.

Departmental areas: Departmental gross area per bed shows a clear increase in the past five years. It should be noted that a number of the units, including the last two winners, are approximately 1,100 DGSF/bed (102 DGSM/bed). Geometry and circulation contribute heavily to unit size and factors determined from net to gross areas.

Overall, the best-practice ICUs have a wide range of gross areas per bed. According to this study, the gross area per bed varies between 654 sq ft (60sqm) and 1074 sq ft (100sqm) per bed. In addition, the average departmental areas consistently differ depending on construction type.

Net-to-departmental grossing factors: Area grossing factors are also of interest to medical planners and designers and differ among construction typologies. It should be noted that within the renovation and mixed categories, net-to-departmental factors ranged as high as 1.74, reflecting the inherent inefficiencies of renovation designs (Table 2).

Patient room design and bed number: The patient room is the most fundamental working module of a critical care unit. The current sample of intensive care environments dates back almost two decades. At that time, the trend of private patient rooms appeared to be rapidly becoming the norm. This is further supported by the fact that no double-occupancy rooms were noted in any of the adult units surveyed.

This study finds unit size of adult ICUs varying between 12 and 40 patient beds, with the average number being 24 and the number of beds occurring most frequently being 20. This is higher than the 8 to12 bed target recommended by the SCCM *Guidelines for Intensive Care Unit Design*[5]. It should be noted that in the larger units, beds are typically grouped into smaller numbers generally reflecting the 8 to 12 bed target.

A comparison of net areas of patient rooms shows a range of values with the largest rooms in units from 2000 and 2008. In both these submittals, while not universally adopted, significant family space has been included in or adjacent to the patient room.

The 1995 SCCM *Guidelines for Intensive Care Unit Design* stipulate: "Ward-type ICUs should allow at least 225 square feet of clear floor area per bed. ICUs with individual patient modules should allow at least 250 square feet per room."[5]

According to this study, the average size of a patient room has remained at around 250 sq ft (23sqm) over the last 17 years. Rooms vary from 189 sq ft (17.5sqm) to approximately 350 sq ft (32.5sqm), with the upper figure a clear exception where large family zones of approximately 115 sq ft (10.5sqm) were incorporated in the patient room.

In seven of the 12 units (60%), patient rooms are very close to the 250 sq ft (23sqm) size.

Space allocation by category: Although patient room sizes appear relatively consistent, departmental areas per bed have increased in recent years. A look at the amount of space allocated for patient rooms provided in each unit demonstrates an average of almost 50%. The remaining space serves as support for the unit.

Therefore, various support areas and service spaces are an important, and growing, determinant of ICU gross area requirements. Recent years have also seen an increase in administrative and education rooms located within units, particularly in academic teaching centres.

Discussion and exemplary designs

The following discussion highlights examples of best-practice ICU designs in conjunction with the categories used in the area take-off analysis of the units. Table 3 provides an overview of program components included in each category. Although not included in the area take-off analysis, outdoor space is included in the following section, given the importance of outdoor space to the well-being of patients, family and staff.

Patient care

Patient toilet facilities and waste disposal: All of the sample units include either a modular sink and toilet within the patient room or a toilet room directly accessible from the patient bed. Two units were found to have private enclosed toilet rooms adjoining the patient room, while three others employ a combination of private and shared toilet rooms. The remaining employed waste disposal systems adjacent to the bed. No award-winning facility built or renovated after 1998 has shared toilet rooms. The 2000 winning unit, with a full bath/toilet, was designed as an acuity-adaptable unit serving patients through the continuum of their stay.

Patient bed location and medical utilities: Within the critical care environment, it is crucial to maintain access to the patient, making the bed placement and delivery of medical support important design considerations. Traditionally, medical devices have been located on a vertical surface at the head of the patient bed, the 'headwall'. More recently the trend has been to use an articulating ceiling-mounted arm(s) with all monitoring, outlets and gases, known as a boom.

Four of the winning units have headwalls. One unit, the 1992 winner, used a single fixed power column. Ceiling-mounted booms were used in the majority of units; three ICUs employed a single-arm boom, while four others employed dual-arm booms. The dual-arm booms have added enormous flexibility by freeing the bed from the wall and integrating technology to deliver critical monitoring. Current research demonstrates that booms have an advantage over headwalls in the case of high-acuity ICU patients and when procedures are performed inside patient rooms. Booms may not provide a proportionate level of advantage when compared with the additional cost involved in their procurement in the case of lower-acuity ICU patients, as well as when procedures are not typically conducted in the patient room[6].

Owen Samuels, MD, ICU Medical Director

Figure 2: Emory University Hospital neurosciences ICU provides a family room adjacent to the patient room

Patient room and technology: The most current competition winner, from 2009, is a good example of a technologically advanced ICU, featuring E-glass (a type of glass that when electrically charged becomes opaque) sliding doors and vision panels between rooms, in-room barcode reader and label printer, wireless IR transmitter and webcam, secure nurse server, and other features.

Staff and material support

Degree of nursing centralisation: In older units, it is common to see a centralised nursing station as the main gathering space within the staff work area.

More recently, this centralised charting area has often been augmented or replaced with decentralised stations. Interestingly, all ICUs surveyed for this study had some form of decentralised charting space with none employing exclusively centralised nursing support. The 1992 Swedish Medical Center ICU allocates space for four central stations, each serving an eight-bed pod and incorporating computer charting terminals inside each patient room.

St Joseph's Health Center is unique to the group as a completely decentralised unit, stating in the submission narrative the main reason for this design shift being noise control (Figure 1). Although nursing support areas do not appear to have grown in overall area during the last two decades, the notion of decentralisation is seen throughout by way of charting stations within patient rooms or within corridors looking into single or pairs of patient rooms. This study demonstrates that the configuration of staff work spaces has not yet been resolved in the best-practice adult ICUs. It remains to be seen whether pure decentralisation will be utilised in future designs or whether a hybrid model will continue, perhaps indicating the value of communication and socialisation between the caregivers.

Staff facilities

There appears to be an increased emphasis on stress-relieving respite spaces for staff incorporating a connection to nature.

The Queen's Medical Center in Honolulu, Hawaii located a central staff lounge for views to the ocean and maintained three lanais, or outdoor patios, for both staff and family access and benefit.

The 2006 winner, Sharp Grossmont Hospital, has a 1500 sq ft (140sqm) exterior courtyard in the centre of the critical care unit. The courtyard also contains a skylight feature which allows for daylight access to

Table 4: Best-practice ICU design trends observed among winning units

Best-Practice Critical Care Design Trends

1 Larger Units More and larger units will likely be needed in the future as need grows. Area for support spaces will likely increase, given the trend observed among best-practice units.	**6 Proximity to Diagnostic & Treatment** Recent units appear to be incoporating diagnostic and treatment modalities into their designs, often as shared services with the entire hospital.
2 The Patient Room All-private rooms in critical care have become the design standard with a stable room size of about 250 SF (23 SM); family space will likely be in addition to this.	**7 Administrative & Support Spaces** An increase in administrative and education space within the unit has been noted over the last several years, particularly within teaching hospitals.
3 The Family Zone Recent units, where possible, incorporate designated family and visitor space and amenities into the unit or within the patient room itself.	**8 Unit Geometry** No single ICU geometry has been noted as superior to another; the pod concept is seen in recent years, along with a combination of different configurations.
4 Technology & Life Support Systems The majority of units, notably recent ones, employed ceiling mounted booms rather than the traditional headwall unit within the patient room design.	**9 Unit Circulation** Distinction of circulation regarding on-stage and off-stage separations are becoming more common and will likley continue to be seen in future designs.
5 Design for Interdisciplinary Teams All units showed some combination of centralized & decentralized layouts for staff work stations, while only two designs were fully decentralized.	**10 Access to Nature** The importance of nature for patients, families and staff is increasingly recognized and incorporated into critical care units where possible.

the emergency department located directly below this space. Along with dedicated staff lounge spaces in all units, five of the 12 ICUs provide an exterior courtyard or terrace for staff access. On-call suites with sleep rooms and shower facilities located on the unit itself are seen in the majority (eight) of the ICUs surveyed, with several locating the overnight facilities just outside the unit for easy access.

Diagnostic and therapeutic

An interesting trend noted across all units is the proximity to diagnostic and treatment support spaces, located either within the actual ICU, close to the unit on the same level, or connected vertically to a location directly above or below the unit by elevator.

The 1992 Swedish Medical Center ICU is located next to the cardiac catheterisation suite and was placed strategically within the hospital to allow lateral access to the emergency room, operating room, recovery room, radiology and laboratory.

At the Memorial Sloan-Kettering Cancer Center, the hospital's haemodialysis suite is incorporated within the ICU providing round-the-clock access to renal technicians while providing two dialysis rooms with ICU surge capacity. The respiratory therapy suite is also located on the floor, serving both the ICU and the overall hospital, and the MRI suite is horizontally accessible.

An integral part of Emory University Hospital's Neurosciences ICU design was the location of a CT scanner within the unit itself, allowing critically ill patients to conveniently undergo scanning without the need for transport to the radiology department. This trend of proximity to diagnostic and treatment (D&T) facilities appears in numerous units in different forms. Interestingly, although the decision of placing the diagnostic facilities within the ICU itself can sometimes mean fewer patient rooms, proximity to D&T services has been chosen over patient rooms in several instances, indicating the importance of these spaces in the view of care providers.

Administration and education

Space allocation for administrative and educational areas within units appears to be on an upward trend, most notably in academic medical centres where teaching is an integral part of daily ICU activities.

All units surveyed contain some offices on the unit, while others include all departmental offices, conference and seminar rooms within the ICU itself. This tendency is illustrated by the two most recent winning entries where a significant amount of unit area is given towards administrative and teaching functions.

In the case of Emory University Hospital, 9% of the departmental gross area is dedicated space for this programmatic function, while at Memorial Sloan-Kettering Cancer Centre's ICU, this number has increased to 14%. Furthermore, there appears to be a preference for staff meeting and education spaces located on the unit itself. At Memorial Sloan-Kettering, a research lab was relocated to allow the administrative suite to be located adjacent to the bed unit.

Conference and rounding rooms incorporating advanced technology to allow for remote patient-care planning have been seen in recent years, specifically in the 2009 winner, the Memorial Sloan-Kettering Cancer Center. It is likely we will observe a continuing trend of administrative and education space incorporated into the designs of critical care environments, especially teaching facilities, given the importance placed on proximity and flexibility of these spaces with patient care areas.

Public and family

Jastremski & Harvey suggest that an ideal patient room should incorporate three zones: a patient zone, a family zone and a caregiver zone[7]. Several of the winning designs have completely re-evaluated the patient room to incorporate designated family space, including families as an integral part of the healing process.

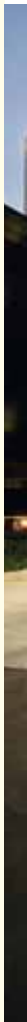
Perhaps the most distinctive in this category is the 2008 winner, Emory University Hospital's neurosciences ICU. This unit is unique in its allocation of 115 sq ft (10.5sqm) of space for a family room incorporated within the patient room, separated by a glass block partition, allowing natural light to penetrate through the family room into the patient zone.

This 'adjacent studio apartment' acts as a private place for respite and communication (Figure 2). The patient room size, including this family space, is over 350 sq ft. Interestingly, 18% of the unit's departmental gross area is dedicated to family space in this ICU, including each family zone within the patient rooms, waiting areas, lounge and amenities such as a kitchen, showers, and laundry facilities.

Outdoor space

With a number of studies showing the benefits of access to nature and its healing properties[8,9], it is becoming more common to see natural elements in the intensive care environment. Legacy Good Samaritan Hospital is perhaps the most extreme example of this with the provision of an extensive external plaza surrounding the unit for use by all users, including staff, patients and families.

This unit design is all the more impressive in that it was a vertical rooftop expansion. The design intent was to provide patients who may be clinically stable access to the outdoors directly from their rooms onto the outdoor plaza. Several units analysed appear to have incorporated light courts into the designs,



allowing for an increase in exterior perimeter and therefore patient room numbers. The majority of units (7) incorporate some form of outdoor spaces into the unit design.

Conclusion

Intensive care units rely on the most advanced nursing care and staff hospitals can provide. Strategies for improving the work environment and positively improving patient outcomes are exemplified in many of these winning entries. This overview has identified important physical design features of some of the best-practice example ICUs in the US and Canada (Table 4).

The current study focused on issues related to overall unit design, patient room design, staff work area design and family area design. This analysis has discussed these issues in relation to the best-practice adult ICUs included in the study sample. This will provide a better understanding of the forces that help shape these designs and promote a discussion of the role of the ICU design community in improving critical care unit designs.

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Authors

Charles D Cadenhead, FAIA, FACHA is senior principal at WHR Architects and immediate past chair of the SCCM/AACN/AIA design competition

Diana C Anderson, MD, MArch is the 2008-09 Tradewell Fellow at WHR Architects

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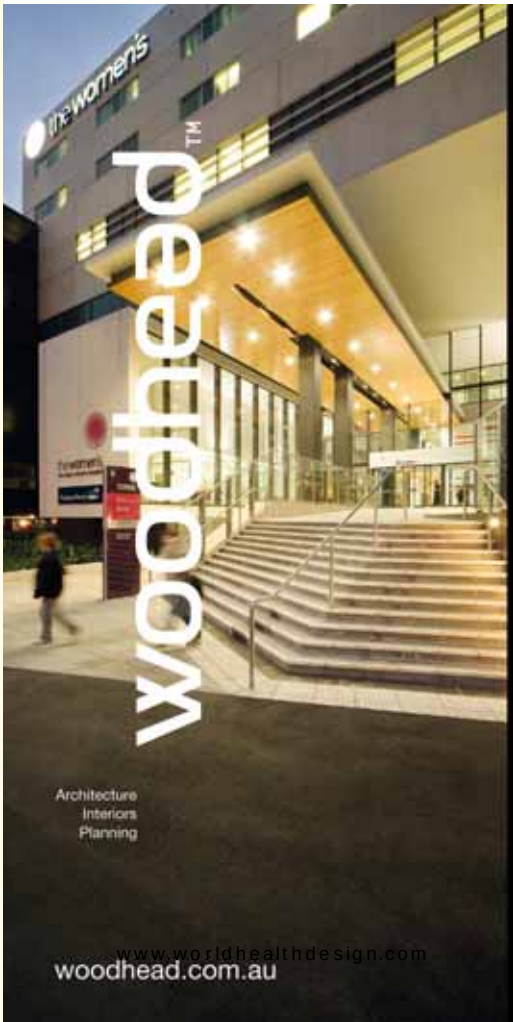

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Although this book has its focus mainly on Europe, the issues discussed within it have worldwide applications, and it is particularly relevant for health economic planners in emerging economies who wish to avoid some of the mistakes made by developed countries. Bite-sized chapters with clear headings and well-argued points make what is a very meaty tome, with lots of serious data, a very enjoyable and satisfying read.

The opening chapter presents a masterful overview of health planning trends and their consequences on hospital design. One somewhat obvious but important conclusion is that the almost impossible task of accurately predicting the outcome of evolving technical innovation and advances in information and communication technology (ICT) can only be mitigated by increasingly flexible hospital design.

The need for a sea-change in the management of long-term care – away from clinician-led, hospital-centred service into a multi-professional community-based model of care – is a refreshing recurring theme in the book.

The evidence gathered on "getting capital investment right" demonstrates an alarming lack of long-term strategic thinking in favour of tactical (and often politically-driven) decisions, resulting in an unacceptably high proportion of project failures, particularly high in the implementation of health-related ICT projects.

Market competition in Europe is not well developed, probably because most countries have a tradition of universal access, equal treatment and a fair distribution of the financial burden. Although some recognise the potential for improving efficiencies, this book advocates much more focused research on what works and what doesn't.

The excellent chapter on life-cycle economics clearly describes the vital relationship between the different functional components of hospitals – 'hot floor' (diagnostic and treatment), hotel (wards), office (outpatients) and factory (labs, CSSD etc) and how their very different life-cycle and adaptability characteristics profoundly affect forward planning. I have rarely seen a more compelling financial rationale for investing in building design quality to ensure initial capital investment is sufficient to benefit from long-term life-cycle economies.

It is surprising, and somewhat alarming, that although 20-30% of costs in a hospital can be attributed to facilities management (FM), there is apparently very little empirical evidence in Europe as to how this money is actually spent. The idea advocated here – of a flexible mechanism that tracts FM costs to specific medical services to enable payment to providers to be linked to particular patient treatments, rather than, for example, general cleaning – has great potential.

A really inspiring chapter on the economic and community impact of local health spending highlights the importance of healthcare as a catalyst for regeneration in deprived settings and as a universal tool for community empowerment, including in wealthy areas. Again, these ideas are hugely relevant outside Europe.

The chapter on sustainable design for health gives a wholly convincing summary of the importance of social, economic and environmental sustainability by clearly describing the considerable challenges facing designers as the critical phases of climate change increasingly manifest themselves. The need for governments, worldwide, to evolve their building standards and finally act on the need to make the necessary capital investments to facilitate whole-life savings is argued very well.

The book's concluding message is a heartfelt plea to embrace future flexibility. The need to improve flexibility is seen as a key lesson and needs to be applied in the widest possible manner, incorporating all aspects of the hospital system, including the scale and scope of facilities, architectural design and supporting infrastructure.

Mike Nightingale is an architect and founder of Nightingale Associates