WORLD HEALTH DESIGN
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OCTOBER 2008

SUPER GREEN

Creating healthy environments in Singapore through eco-design

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Last chance saloon

As the world reels from the financial storm that has blown through global banking institutions, it would be easy to forget what really matters in the real economy.

Health capital is central to the socioeconomic progress of nations in the east and the west, and in the developed and developing world. It is also integrally linked to the sustainability of our environment, where innovative approaches to green design are key to addressing climate change, in what could be our 'last chance saloon'.

Research demonstrates that a connection with nature is central to our health and wellbeing. In this issue, we feature Ken Yeang's signature 'Super Green' design for a £55m mixed-use research and science building in Singapore on the cover and in our new Placemaker photo feature (see pp 10-11).

More international examples of benchmark 'green' designs are explored in the new book *Biophilic Design*, reviewed by Phil Astley on p76. Are we ready as designers, clients and developers to speak a new language of value and performance that properly accounts for the morphological and biodiverse cost benefits of eco-environments?

It's perhaps no surprise that Arup is leading the way in eco-infrastructure design and we wait in anticipation to see whether its eco-exemplar for the first zero-waste city at Dongtan in China becomes a reality (pp22-27).

Our special features on China and Eastern Europe demonstrate, however, that despite rapidly growing demand for health, only a few western architectural firms have managed to meet the cultural and economic challenges of designing in these regions.

In our scientific review, the impact of urban design on health and wellbeing is explored by Dr Mary Anne Akers in a study of street vendors in the Philippines (pp59-63), awakening us to the health conditions that result from the marginal, temporary and fluid existence of outside workers – a global phenomenon that is certainly not exclusive to the developing world.

Marc Sansom
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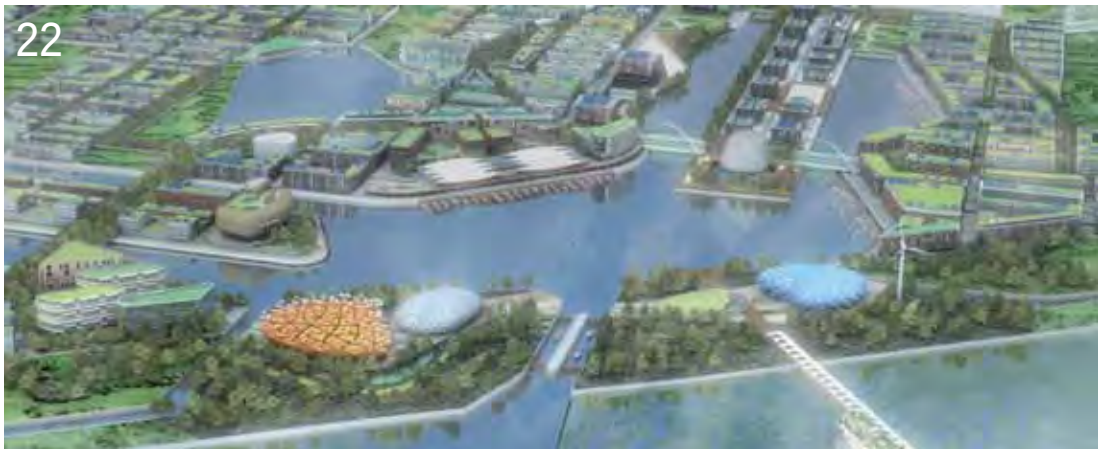

BRIEFING

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ARTS & CULTURE

World experts come to Singapore

Delegate registrations are already pouring in as Singapore prepares for the Design & Health 6th World Congress and Exhibition, scheduled to be held at The Ritz-Carlton Millenia in Singapore, 24-28 June 2009

Following a record number of scientific and professional submissions for next year's Design & Health world congress – the foremost global event promoting interdisciplinary research and practice – interest is building fast. Delegates are signing up to hear world-renowned speakers from every part of the globe.

Sessions will include presentations by physicians, psychologists, designers, architects, planners, artists, nursing professionals and economists, bringing together a rich blend of interdisciplinary perspectives. Topics will include the latest research findings in the field including: design quality standards; evidence-based design / research-based design; mental health; restorative justice; senior care; and children's and young people's healthcare.

In addition, trends and influences on design and health will be considered in sessions covering different global locations, including: the Middle East, China, India, South East Asia, Europe and the US.

Founder of the International Academy for Design and Health, Professor Alan Dilani said: "At a time of great uncertainty following the global financial crisis, it is important to remember that a country's health capital is the new indicator of economic wealth, and that infrastructure investment decisions must continue to be evidence-based and founded on credible research.

"Our network, who by attending in Singapore next year, will benefit from the opportunities to share, create and disseminate knowledge at an international level, will be the same people and organisations who will thrive in the future, as we develop new paradigms that place design and health at the centre of the world's socioeconomic development."

Design & Health 6th World Congress and Exhibition
Uniting the disciplines of architecture, design, psychology, the health sciences and economics
24-28 June, 2008 The Ritz Carlton, Singapore
www.designandhealth.com

Craig Dixon, director of consulting, Tribal Consulting

Michail Kagioglou, co-director, HaCIRIC, Salford University

Healthcare Infrastructure event brings international perspective

Influential speakers of international renown will lead a heavyweight line-up at Healthcare Infrastructure 2008 in December – a new event aimed at evaluating future health capital investments in the community.

As healthcare around the world comes to terms with ever rising demand and increasing costs, this new conference, organised by Building Better Healthcare in association with the International Academy for Design & Health, aims to address the key drivers shaping future capital investments in our healthcare infrastructure.

International speakers will join a programme that also includes UK speakers from the Commission for Architecture and the Built Environment, the King's Fund and Community Health Partnerships. In a unique programme, current government policy will be reviewed alongside real-life examples of best practice and reports on the latest research findings in the sector, ensuring an interdisciplinary event that will attract policy makers, health managers, estates and facilities managers, clinicians, health planners, architects, designers, developers and university-based researchers. The new conference will address how a more flexible healthcare infrastructure with a community focus is better placed to meet the changing needs of patients, and embrace rapid advances in medical and information technologies.

Healthcare Infrastructure 2008: Building Better Healthcare in the Community
2 December, 2008; The Savoy Place, London
www.binleys.com

UK: The 'Alex' wins again

Last year's winner of the Design & Health Best International Project award, the Royal Alexandra Children's Hospital in Brighton, has scooped the UK Prime Minister's Better Public Building Award. Designed by BDP, the project was delivered by PFI consortium Kajima Partnership.

US: Safety first

A new organisation called Patient Safety Design Consultants, LLC – Architecture for Safer Healthcare has been launched to advise medical professionals and design firms about the relationship between the physical environment and its impact on the safe delivery of care. For more information, visit patientsafetydesign.org

Australia: Call for papers

The Australian College of Health Service Executives and the University of New South Wales' Centre for Health Assets Australasia are calling for abstracts for papers and posters for the ACHSE 2009 National Congress, which will take place from 4-7 August, 2009 on the Gold Coast. The deadline for abstracts for papers and posters is 28 November and should address the theme of 'Building our Healthcare System around People and their Needs'. More information is available at: www.achse.org.au/frameset.htm

Canada: Loneliness makes you cold

A team of scientists from the University of Toronto have found that social isolation can make people feel cold. Dr Chen-Bo Zhong, who led the research, which is published in *Psychological Science*, said: "This may be why people use temperature-related metaphors to describe social inclusion and exclusion."

Ireland: Anshen + Allen project win

Anshen + Allen is part of the Northern Ireland Health Group consortium, which has been appointed preferred bidder for the new acute hospital in Enniskillen, Co Fermanagh. The £267m scheme will be located among wooded hills, meadows and lakes, and represents a genuine integration of building and landscape in an environmentally and socially sustainable design.

UK: HOK to design research lab

HOK is to design the UK Centre for Medical Research and Innovation (UKCMRI), which will be built on 3.6 acres of land, close to St Pancras Eurostar terminal and the British Library. Set to open in 2014, it will house 1,500 scientists. The lab will replace the National Institute of Medical Research (NIMR).

US: Vaginal birth mums sensitive

A new study has found that mothers who delivered vaginally compared to caesarean section delivery were more responsive to the cry of their own baby, identified through MRI brain scans two to four weeks after delivery. The results of the study were published in The *Journal of Child Psychology and Psychiatry*.

Bahrain: Community masterplan

A masterplan for a new Water Garden City in Bahrain has been revealed by designers HOK. The huge 2,200,000m^2 scheme will include the development of residential accommodation, hotels, schools and commercial, leisure and retail space for a community of up to 40,000 people.

UAE: New city in Dubai

Japanese architectural firm Nikken Sekkei has been appointed to design Jumeira Gardens, a new 350-billion dirham ($95.3-billion) city in the emirate of Dubai in the United Arab Emirates (UAE). The contract was awarded to the firm by the government-owned developer, Meraas Development.

Canada: PPP win for Stantec

Stantec has been named part of the Infusion Health consortia contracted to deliver a C$432.5m expansion project, undertaken as a public-private partnership with the Interior Health Authority of British Columbia. Stantec will provide architectural, mechanical, electrical, structural, civil and Leadership in Energy and Environmental Design (LEED) consulting services for both the Kelowna General Hospital and Vernon Jubilee Hospital.

US: Green credentials for design

The Parrish Healthcare Center at Port St John, Florida, US has received LEED Silver certification from the United States Green Building Council. Designed by RTKL, the facility's architecture takes advantage of its natural surroundings and incorporates a variety of green building principles.

New research publication

Arup has published its first Research Review to promote the firm's research capabilities to universities, academics, funding organisations and clients. The publication demonstrates the quality and credibility of the firm's research capability through case studies highlighting the benefits of collaborative working and Arup's continuing impact on key research developments internationally. For more information, contact: Marta Fernandez at marta.fernandez@arup.com

US: Natural alliance

HOK and the Biomimicry Guild have forged a 'first-of-its-kind' alliance linking the natural and built environment. The relationship will see the integration of nature's innovations in the planning and design of buildings, communities and cities worldwide. Established by biologists Janine Benyus and Dr Dayna Baumeister in 1998, Biomimicry is a science that studies nature's best ideas and imitates these designs and processes to solve human problems.

Canada: Carillion team shortlisted

Montgomery Sisam is a member of the Carillion Canada team which includes HOK Architects, Vanbots Construction, Carillion/Vanbots Services Bridgepoint, and CIT Group Securities (Canada) and has been shortlisted to design, build, finance and maintain the new Bridgepoint Hospital in Toronto. The winning project team will be selected in early 2009 with construction of the new facility scheduled to begin shortly after.

UK: Three up for global award

The Intermountain Medical Centre in the US, designed by Anshen + Allen, NBBJ's Washington Medical Center in the US and the Midland Regional Hospital in Tullamore, Ireland, designed by Murray Ó Laoire and Brian O'Connell Associates, have all been shortlisted for the Best International Project at the UK's Building Better Healthcare Awards, supported by the International Academy for Design & Health.

South Africa: Nightingale new office

Nightingale Architects (SA) has opened for business in Cape Town. A part-owned subsidiary of Nightingale Associates, Nightingale Architects (SA) is 26% owned by historically disadvantaged individuals and has been independently verified as a Level 3 broad-based black economic empowerment (BBBEE) service provider.

UK: Building better health e-zine

Building Better Healthcare, in collaboration with the International Academy for Design and Health, has launched an electronic magazine focusing on the planning, design, financing, procurement, construction and management of the UK healthcare estate. To download the first issue, visit: www.bbhealthcare.co.uk

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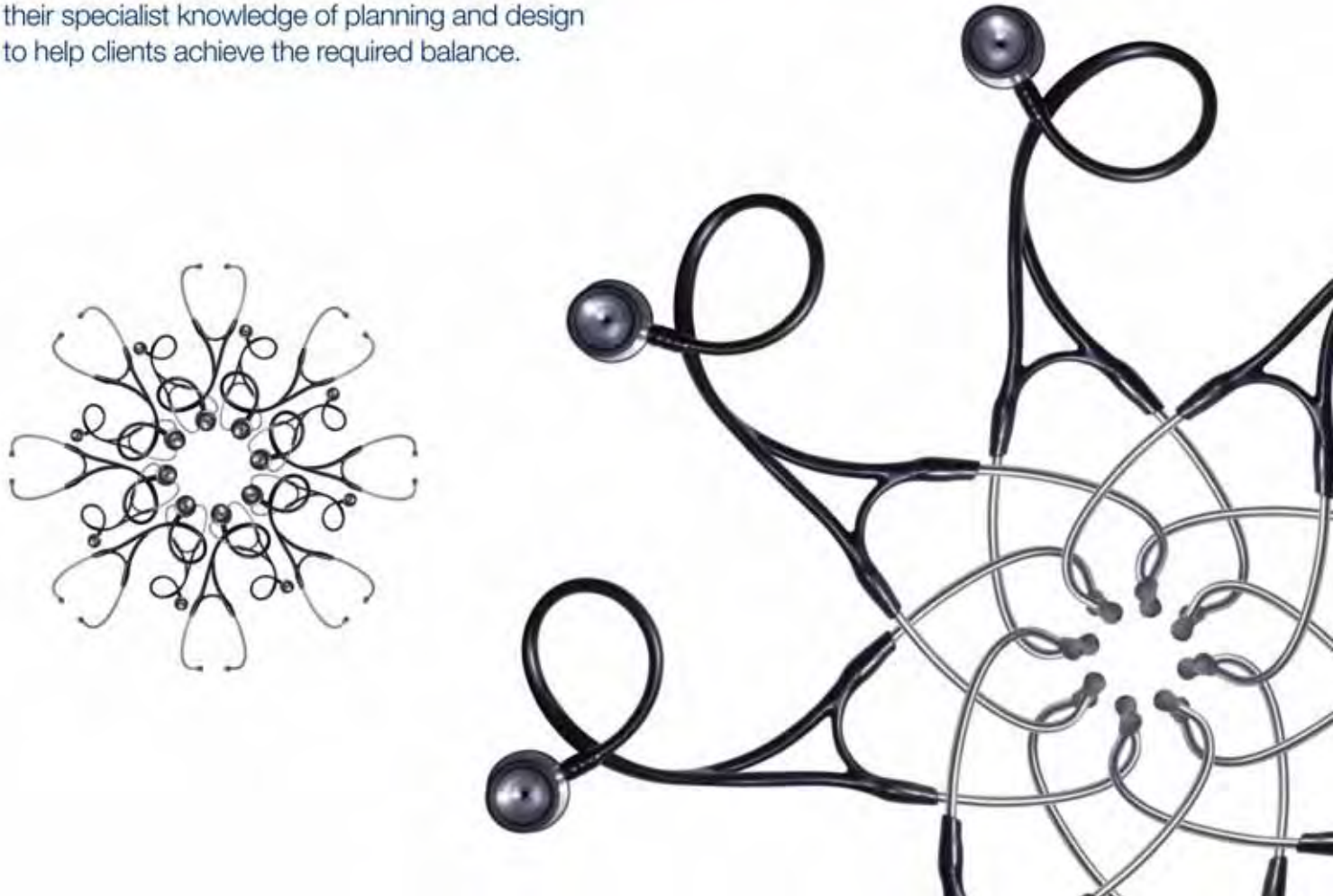

Experts call for action on design quality

Four leading international healthcare organisations have joined forces in the development of an initiative that aims to improve standards in the design quality of healthcare facilities around the world

Professor Alan Dilani, director-general, International Academy for Design and Health

Dr Eric de Roodenbeke, director-general, International Hospital Federation

Professor Per Gunnar Svensson, president, International Academy for Design and Health

In a meeting held last month in Geneva, the World Health Organization (WHO), the International Hospital Federation (IHF), the Union of International Architects and the International Academy for Design and Health decided on an action plan for establishing a global forum for the exchange of knowledge on the development of standards in healthcare facility design.

The action plan will include the creation of an international reference group to inform, though the dissemination of examples of best practice and exemplary design from around the world, the development of national and international guidelines for healthcare design.

The reference group, which will be interdisciplinary, will aim to:

- maintain and enrich the integrated planning software developed by the WHO and to promote its use in different countries
- develop indicators to measure the impact of the healthcare infrastructure on the health and wellbeing of patients, staff and visitors
- engage a global study on capital investment in relation to health outcomes, with a focus on developing an understanding of the decision making process leading to capital investment
- update the guidelines for healthcare facility planning worldwide.

Hosted by IHF general director Dr Eric Roodenbeke, the meeting was attended by Dr Andrei Issakov, WHO health technology and facilities planning co-ordinator at the World Health Organization, Hans Eggen, director the Union of International Architects' Public Health Group, and Professor Per Gunnar Svensson and Professor Alan Dilani of the International Academy for Design and Health.

Calling for an international effort to support improvements in the design quality of healthcare facilities, Dilani said: "Healthcare facilities are highly complex and subject to continuous changes in use and function, reflecting an ever-changing political, social, economic and technological context for healthcare provision.

"The healthcare environment also has a great impact on the standard of service provision and the healing process, which is supported by significant research findings that demonstrate a clear relationship between the quality of healthcare design and health outcomes.

"Whilst the specific needs of different countries should always determine the design outcome, political and financial pressures may often take priority. These pressures can be overcome through the wide dissemination of knowledge and international expertise in order to fill the knowledge gap and help to raise the standard of healthcare facilities all over the globe."

The first meeting of the reference group is scheduled for the early part of 2009 in Geneva. Up to 30 key stakeholders will be invited to participate in the initiative, which will be launched by the WHO during a workshop event in 2009. WHD will publish regular news updates on the initiative and its outcomes.

To contribute to the initiative, the Design & Health network and other interested organisations should contact Dr Alan Dilani at dilani@designandhealth.com or Dr Eric Dr Roodenbeke at ederoodenbeke@ihf-fih.org

Super green

Super green design will be the signature of a new £55m mixed-use research and science building in Singapore. The project, designed by Llewelyn Davies Yeang's sister company in Kuala Lumpur, T R Hamzah & Yeang, and the Soilbuild Group, will form part of the iconic Fusionopolis cluster, a focal point of Singapore's science, engineering and media industries.

The Fusionopolis Phase 2B building will be the latest addition to the 200-hectare, one-north site in central Singapore, next to its acclaimed science parks and close to the National University. The site lies within a masterplan designed by Zaha Hadid Architects. Soilbuild was awarded the contract in April 2008, following a competition held by the Jurong Town Corporation (JTC). The proposed facility will have a site area of 7,734 square metres and a plot ratio of 6.5, as well as the potential to develop up to a maximum gross floor area of 50,271 square metres. The development cost is estimated to cost about S$148m and will take 22 months to complete.

The design aims to achieve the Singapore Government Building and Construction Authority's highest rating for green buildings – the Green Mark Platinum award. The building is designed to be distinctive with a green aesthetic, featuring a veranda-way surrounding the building at ground level, said to be reminiscent of the traditional Chinese shophouse semi-covered walkway. Spiralling around the building's exterior is Ken Yeang's signature 'ecoinfrastructure', a 1.4km-long recessed continuous landscaped feature that wraps itself around the building's façade.

The ecoinfrastructure will complement the building's gardened rooftops and an 'eco-cell' at the basement that enhances the biodiversity of the site. The building has a novel solar shaft that is an inclined oversized light-pipe which brings daylight into the inner parts of the building.

Besides the enhanced biodiversity landscaped features, other proposed green features include rainwater harvesting, roof gardens to reduce solar heat gain, solid waste separation and recycling.

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Learning the lesson

Successful capital projects in Europe require much more than good architectural solutions, healing design and environmental sustainability, claims *Bernd Rechel*

Each year, many billions of euros are spent on capital investment projects in the health sector across Europe, and this amount is likely to increase in the coming years, as many countries face a backlog of maintenance and refurbishment.

Nowhere is the need greater than in Central and Eastern Europe, where levels of capital investment have been particularly low over the last 30-40 years.

When funds become available to address the long-standing lack of capital investment – for example through structural funds for new EU member states or the oil boom that countries like Russia or Kazakhstan are experiencing – there is a real danger that resources are not spent in the most effective and sustainable way. Before rushing into building new facilities, there are some key lessons to be learnt from capital investment in Europe.

What should precede any capital projects, is a comprehensive analysis of health needs and how these needs should be translated into services and appropriate facilities. Long gone are the days when hospital beds were seen as an indicator of a good healthcare system, such as under the Soviet Union, which placed great emphasis on a large number of hospital beds and physicians.

Health facilities should not be perceived mainly in terms of buildings, beds or specialties, but rather from the perspective of the patients who are treated in them and the processes delivered by the health professionals who spend their working lives in them.

This approach entails going beyond the single health facility and taking account of the whole trajectory of care. Far too often, capacity planning in the health sector fails to move beyond hospitals and does not take account of the overall health needs of the population and the spectrum of health services required to meet those needs.

Health facilities also often continue to be used beyond their functional lifespan and reflect outdated patterns of care – such as the large number of tuberculosis hospitals throughout the former Soviet Union that are at odds with modern approaches to tuberculosis treatment. Flexibility must encompass all aspects of health facilities, including their scale and scope, architectural design, supporting infrastructure, services to be provided, relationships with the rest of the health system, revenue financing, and sources of capital investment. Paradoxically, in a few countries, policy is moving in the opposite direction – the Private Finance Initiative in the UK involves contracts, which are specified in great detail for the lifetime of a project, usually around 30 years, with very little scope for change.

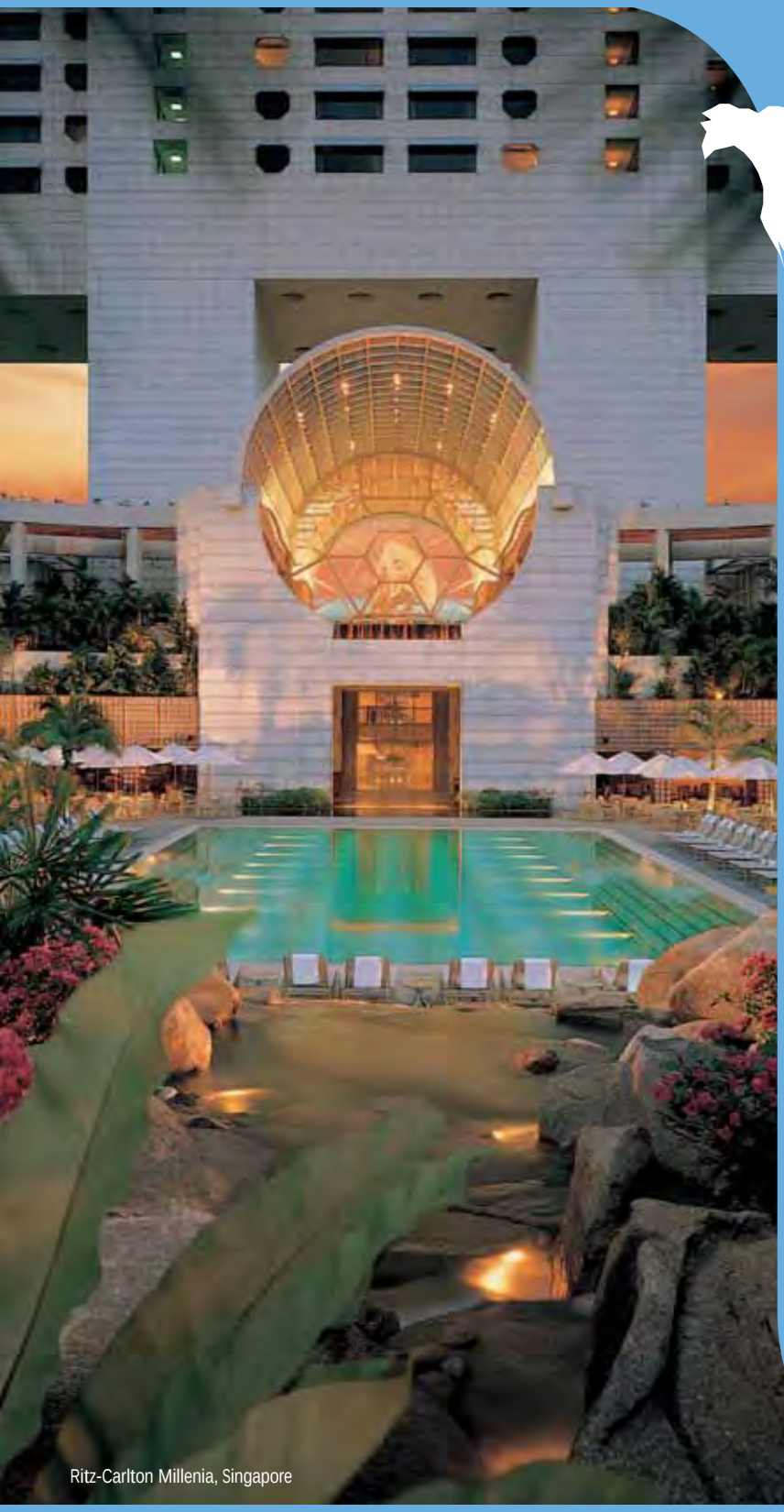
Effective capital investment requires intelligent financing mechanisms, both for services and capital. In terms of services, resource allocation should reward outcomes rather than capacity and provide a smooth patient journey across different levels of care. With regard to capital, the cost, risks and value of capital have largely been ignored across Europe, with investment and revenue costs belonging to different streams, removing any incentive for hospital managers to manage assets efficiently. This traditional split is gradually eroding in many European countries, as hospitals are increasingly becoming responsible for their capital assets.

The cost, risks and value of capital have largely been ignored across Europe

It is abundantly clear that successful capital projects require much more than good architectural solutions, healing design and environmental sustainability. They will need to be based on an assessment of health needs, comprehensive capacity planning, a whole systems perspective, systematised care pathways, anticipated flexibility and intelligent financing solutions. None of the countries in Europe has perfect solutions for all these issues and those involved in planning major capital projects are well advised to try and ensure the long-term effectiveness and sustainability of anticipated health facilities.

Bernd Rechel is a lecturer at the London School of Hygiene & Tropical Medicine and a researcher at the European Observatory on Health Systems and Policies. He will be presenting a paper on 'Hospitals of the Future: Improving the Effectiveness of Health Capital Investment' at Healthcare Infrastructure 2008: Building Better Healthcare in the Community on 2 December at the Savoy Place in London. For more information on this event, which is endorsed by the International Academy for Design & Health, see p6.

Uniting the disciplines of architecture, design, psychology, health sciences and economics



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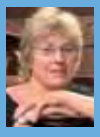
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Or for a delegate booking form, contact Prof Alan Dilani: academy@designandhealth.com

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Cultural challenges

Phil Nedin and *John Cooper* go head to head on the role that research and evidence-based design can play in improving the quality and performance of the global health estate

Used by architects, interior designers, engineers, and estates and facilities managers in the planning, design and construction of healthcare buildings, evidence based design (EBD) is one of the more popular tools available within a rich and complex tapestry of research methodologies.

Project teams, working with informed clients, applying an EBD methodology, create a design solution following an assessment of the best available information from the research literature, post project evaluations and from evidence collated from the client's own operations.

A successful EBD solution, tested and measured regularly, should then demonstrate improvements in clinical outcomes, economic performance and patient, staff and visitor satisfaction.

The founding principles of EBD are in the main without dispute. Where controversy reigns appears to be where the methodology has been cannibalised or misused for commercial gain in order to convince decision-makers to rightly or wrongly commit to a capital investment.

Fad or fashion

Speaking in a live debate, hosted by the International Academy for Design & Health at the UK's annual Healthcare Estates conference earlier his month, Anshen + Allen director, John Cooper and Arup's global head of healthcare, Phil Nedin both recognised EBD as an international issue, but one which should be considered within local cultural contexts.

Tackling attacks on EBD as a 'design' fad or a fashion, Cooper said: "Is EBD yesterday's buzz-word? Has it been displaced by 'lean thinking'? Is EBD a thing of the past? Let's not simply throw the evidence out because it's been misused."

He recalled design briefs in the late 90s that demanded new healthcare facilities to possess 21st century qualities, querying: "Isn't it amazing that here we are in 2008, and we're still calling for 21st century hospitals?"

Cooper's suggestion is that the UK has missed a trick and an opportunity to build an evidence base that will support and inform future design solutions, questioning whether anything has been learned about the impact of design on nosocomial infection, reducing patient falls or increasing staff retention. He says: "In the UK, between £17-23 billion has been spent on the healthcare estate in the last ten years, but precious little has been learned."

Comparable methodologies

EBD first came to the fore in the US as the design equivalent to evidence-based medicine, which Nedin points out is at the heart of healthcare provision. "No therapy, drug or procedure is offered unless the necessary research and repeatable clinical trials have been successfully conducted."

Recognising, however, the complexity of making a fair comparison of the value of applying similar scientific methodologies to clinical and non-clinical subjects, Nedin, whilst supporting the principle of research, identifies some important caveats. "Take the idea of the therapeutic environment, which architects, designers and psychologists are endorsing. It is largely intuitive that good acoustics, environmental control, natural ventilation, lighting, colour and art can bring patient benefits, but there are also increasing numbers of studies to support its case too.

"However, patients are spending less and less time in hospital environments – an average of 3.5 days rather than

11 days in the 1970s. Diagnostics is more regularly performed as an outpatient activity rather than as an elective procedure.The payback on the therapeutic environment is now longer per individual patient," explains Nedin.

Complex relationships

The second caveat, he suggests, is concerned with the credibility of the evidence, and the ability to repeat a research study, given the complexity of the relationship between clinical outcomes and environmental space.

In the modern world of medicine, where the patient rather than the disease is increasingly the focus of care, Nedin says: "On what basis do we select patients for research? Each patient has their own unique clinical condition/s, and mental and physical characteristics, different levels of stress, and a specific drug regime.

"They will also hold different perceptions of the different models and levels of care they are subject to, and of the environmental space around them, not to forget different levels of social support from families and friends."

Cooper suggests however that it is possible to measure the variables and develop an evidence-base, citing the work of the Centre for Health Design in the US, and particularly the Pebble Project, of which the new Pembury Hospital in Tonbridge Wells, UK, designed by Cooper, is a member. "There are over 600 studies in the US which will withstand peer review and demonstrate the impact of good design on clinical outcomes.

"It's about taking a new building and making it a pre-requisite to measure the variables," explains Cooper.

By being a part of the Pebble Project, the Pembury Hospital is subject to an EBD approach that takes a small set of variables, such as nosocomial infection, the reduction of patient falls and the misapplication of drugs, and compares the outcomes in the new facility with those of the old facility. "We can then see whether the evidence that supported the design solution has been rightly or wrongly applied," says Cooper.

As a member of the Pebble fraternity, Cooper says he receives 30-40 e-mails every week saying, 'Do you know anything about this?', 'What's happening here?' or 'We've learnt this'. He says: "A member of the estates staff we worked with in the US spent six months working out which carpet offered the least resistance to pushing a trolley along. The work is invaluable because you can use it.

Cultural drivers

Cooper also recognises however that local cultural contexts must be taken into account when assessing the evidence. "If you go to Europe and talk about infection control, or if you go to the US, you'll find a lot of what we consider to be best practice is entirely cultural. It's not absolute and that is a difficult issue when you're building an evidence-base."

In the US, he explains, "they use carpets in places we would never dream of, supported by a culture of steam cleaning once a week. We all operate within very different clinical as well as operational cultures internationally which adds another layer of complexity."

Phil Nedin adds that examples such as the use of carpets versus vinyl flooring also demonstrate how different interpretations of the evidence may depend on the research objectives. "There is an assumption that the safest floor covering is a vinyl floor. But if you're dry sweeping a vinyl floor or a visitor leaves the building dragging their coat behind them, all manner of dust and matter carrying a microbiological load can be stirred up.

"So suddenly, we're beginning to think that carpets are pretty good

"As a practising architect, I've only once ever been given clear measurable objectives"






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because they act as a blotting paper – when the particles settle, they settle for good. But you must have a means of cleaning the carpet properly."

Cooper adds, however, that research can also be used to challenge cultural paradigms. "There is apparently no evidence whatsoever to support the use of laminar flow curtains in orthopaedic theatres, and in the US they don't use them.

"Any why are the British more combustible than any other nation? HTM81 is far more onerous than any other fire code in the US, Europe, Australia or any other area in which I've worked. This is an extraordinary restriction as we move towards 100% single rooms.

"Much of what we design is shaped entirely by the rigours of fire code. Research is needed to validate different hospital arrangements that do not increase the risk of mishap or injury due to fire."

Danger of complacency

Despite his warnings about the use of evidence, Nedin says the danger is not getting proper research done that will help to develop the evidence-base. "Real problems emerge when something is intuitive and you try to write guidance around it without the research to support it."

Recalling a recent conference presentation he gave in the US, Nedin said: "I put up a slide of a map of the US divided into 30 different areas to demonstrate the changing climate from north to south, and east to west.

"In some of these regions, you can naturally ventilate for 80-90% of the year, in other areas you may not have considered appropriate, natural ventilation is possible for 50% of the time. In other areas, where the humidity is high, there may be ways of addressing that problem. Both the architects and the engineers said they would love to do that, but that the code ensured that the first decision was always to seal the hospital."

Warning against complacency, Nedin said that when pressed on how the code had been developed to support sealing of the hospital, the designers said that when asked to attend the guidance meetings, they had sent a junior staff member, whilst the manufacturers of the air handling units had sent their managing director.

Nedin said: "It was a business opportunity. If the air handling people could seal the building they would sell lots of kit. There's a lesson here, that we must not be complacent or we'll soon have laminar air flow units and hepa filters everywhere!"

Make it mandatory

Cooper suggests that the only way to overcome similar knowledge gaps and ensure a continuous and comparable cycle of research is to make it mandatory that every pre-business case sets out its clinical policies and explicitly establishes clinical goals and objectives. "Rather than talking about world class facilities, let's define it. As a practising architect, I've only once ever been given clear measurable objectives.

"The clinical objectives should be in every brief, so that we can apply the evidence to achieve them. Let's also make it mandatory that there is a universal or comprehensive methodology for post-occupancy evaluation. Every facility over an agreed value should be evaluated on an annual basis in its first five years of operation, and then we will generate the evidence we need."

In a final warning, however, Nedin says: "We have to be careful because even evidence can be ignored. Look at smoking. We package cigarettes that say, 'give us your money, and we'll kill you' and people still buy them. But without good research to influence the guides, we'll get guides that tell us the wrong thing, so we must never be complacent."

Marc Sansom is editorial director of the International Academy for Design & Health

Phil Nedin

2008	Director, Healthcare Business Leader - Arup
2008	NHS Design Review Panel member
2006 – 2008	President of Institute of Healthcare Engineering and Estate Management (Now Immediate Past President)

John Cooper RIBA ARB

2002 – Present	Director, Anshen + Allen
Present	CABE Enabler
1981 – 2002	Founding Director, Avanti Architects
1972	BA (Hons), Diploma in Architecture, University of Cambridge

Does one size fit all?

Increasingly recognised as an industry standard in the US, in other areas of the world the jury is still out on the 100% single patient room model of care. Our four experts consider when, where and for whom single patient rooms are appropriate

In the Canadian system, existing hospital wards contain an assortment of patient room types, including private, shared and the four-person ward room. But As the US moves towards a private room healthcare model for new construction, does 'one size' fit all? Before this design guideline becomes the industry standard, we must consider the issue from both a medical and a design perspective. Are private rooms beneficial for all patient populations? Will this design concept alter important psychological and social aspects which accompany the process of illness and healing? How will this change the experience of hospitalisation?

Along with private patient rooms, some US facilities now incorporate private pre- and post-operative rooms, in contrast to the larger open spaces which separate patients with curtains. In this new scenario an individual undergoing a procedure might never see, or be in, the same room as another patient. This characteristic of prospective inpatient facilities may enhance the sense of fear and disruption that accompanies the hospitalisation experience. In addition, family zones are now provided in each patient room, but there may not always be visitors there to provide companionship.

More research is needed to explore the impact on various patient populations

For some patient groups, most notably palliative care, geriatrics, and certain paediatric groups, shared spaces can provide social supports for patients and families which are beneficial in the healing process, decreasing the sense of alienation often felt in the wake of medical illness. A cost-effective design solution may be one where smaller private rooms are provided with more area devoted to a variety of social spaces. This need not be limited to designated lounges found at the corridor's end, but benches and alcoves could be provided in the hallway space outside each room to promote interaction, while allowing an easy retreat when isolation or privacy is desired.

Before we accept the private room model for all medical wards, more research is needed to explore the impact on various patient populations. Through the design of flexible spaces to accommodate individual preferences, patients and families can maintain an element of choice for room type. Ultimately 'one size' may not fit all.

Diana Anderson MD, 2008-2009 Tradewell Fellow,
WHR Architects, USA

By now, we've all heard the arguments for and against single-bed wards. Even as this debate wages on, however, much of the world is moving – and will continue to move – toward this patient room model, not only in the US and Western Europe but in Eastern Europe and the Middle East as well.

The arguments, particularly surrounding the heightened risk of infection, continue to stack up in favour of it. Not only that, but as healthcare worldwide becomes an increasingly commercial venture, patients and markets are demanding it.

On the other hand, single-bed wards are not always economically feasible. In many countries, the objective is simply to bring the quality, efficiency and accessibility of care up to an international standard. Even in places where the healthcare system is fully developed, social health services are often better served with more economical solutions that provide a mix of single and multi-bed rooms.

Cultural issues also play a role. In many developing countries, there are conflicting requirements driven by the substantial separation between the very wealthy and the poor; the need for affordable healthcare; and the desire for flexibility to accommodate a large family entourage. For any designer working globally, an understanding of context and culture is crucial to determining the ideal mix.

Single-bed wards are not always economically feasible

Ideally, single-bed wards will grow to become the industry standard in the interest of delivering the best healthcare worldwide. In the meantime, it is our responsibility as healthcare designers to bridge the gap between the two types of rooms, reducing the drawbacks and exploiting the benefits.

Alan Morgan, director, RTKL Associates, UK

The debate about single hospital rooms continues to preoccupy the UK's NHS as it strives towards a model for 21st century healthcare. Whilst some initiatives for change might be compared to rearranging the deckchairs on the Titanic, others – improving infection control, enhancing patient dignity and privacy – are all crucial.

I believe that single patient rooms have major benefits. However, not everyone is convinced. The elderly, in particular, tell us at public consultation meetings that they fear soulless corridors and the prospect of dying alone and unnoticed by hospital staff. Healthcare architects play a key role in persuading potential patients that their fears about single rooms are unfounded.

The US experience offers hope for a patient-focused model of care

The Ulrich model and the US experience offer hope for a model of care which will provide all the benefits of patient-focused care – shorter recovery times, better infection control, more efficient bed management, efficient bedside use of some hospital facilities (physiotherapy, pharmacy, pre-operative assessment) – thereby producing an overall improvement in the patient experience. The capital cost of providing single rooms will, of course, increase as hospitals become larger. As a society, we must decide on the relative merits of increased costs since the rewards are considerable. In the future, if we do achieve a higher ratio of single rooms to wards, we may wonder what the fuss was about.

Some things, with the benefit of hindsight, are obviously worth doing. Then the image of the 'Carry on Doctor' style hospital will be a historic one.

Chris Pye, partner, Watkins Gray International, UK

The Australian health system is one of the best in the developed world in terms of health outcome indicators, and at a cost of approximately 9% of GDP (similar to the UK) offers high quality, equitable and accessible healthcare to the Australian people regardless of age, employment, health status or income. It does this at a fraction of the cost of the US system which costs approximately 15% of GDP – a system that also scores a great deal worse on many of the same health outcome indicators where Australia excels.

Although the debate for and against 100% single rooms for inpatient facilities may be won in the US, it continues without definitive conclusion in Australia. Recent Australian research suggests that although there are many benefits associated with 100% single rooms, there are also significant additional capital and recurrent costs. The question must then be asked whether 100% single rooms is the best way to spend valuable, yet ultimately limited, Australian health dollars or is it possible to accept a lower percentage of single rooms (say 50-60%) and spend the money that is saved on other important health initiatives?

Are 100% single rooms the best way to spend valuable Australian health dollars?

With an increasingly ageing population, greater demands for costly technology, diversification of care from the acute sector into the home and community, plus an increasingly limited medical and nursing workforce, it is obvious that we simply cannot have it all!

The debate is ongoing and the 'evidence' continues to be gathered, reviewed and assessed to support a decision regarding the proportion of single rooms appropriate for the Australian health system. Ultimately, we must spend health dollars wisely to achieve the best possible health outcomes for our population. Our facility-related decisions, such as the proportion of single rooms, must accord with this reality.

Jane Carthey, director of the Centre for Health Assets Australasia (CHAA), Faculty of the Built Environment, University of New South Wales, Australia

China rising

There are more than 320,000 hospitals and clinics in China, most of them either undergoing – or needing – refurbishment. What opportunities are being created for enlightened and progressive new healthcare buildings? *Veronica Simpson* reports

It would be impossible to calculate the billions that have been spent transforming China's cities in the last five years, as that great, once communist nation embraces consumerism, capitalism and modernity. But while western eyes widen in amazement as shiny steel and glass skyscrapers and 12-lane highways are constructed in a matter of months by the vast Chinese workforce, there has been growing concern that, in the rush to dazzle the world's TV cameras assembled for this year's Olympics, little or no attention has been paid to infrastructure. The health and wellbeing of the community certainly seems secondary to the lust for new, statement office blocks and stadia. International architecture practices are generally steering clear of involvement in healthcare projects – even if they're active in other sectors in China – because of a perceived difficulty in achieving quality outcomes, or realistic fees.

Brad Barker, managing director for RTKL's healthcare practice worldwide, says: "Quality healthcare is beginning to emerge as a priority, but not at the pace of commercial development. In addition, most commercial development is driven by entrepreneurial ventures, while healthcare is a function of the government and, therefore, lacks the competitive element that drives a commercial project."

He admits the practice has had its fingers burnt by a common tendency to bring in international consultancies for design inspiration and then leave them high and dry. "I must admit our two experiences have not been positive. In both cases we were never paid in full for our planning/design services and as a result, we are not spending much time on this market."

Despite having offices in the region, Steffian Bradley, Atkins and NBBJ have, for now, also steered clear of any healthcare projects, as has Llewelyn Davies Yeang (LDY). But it's not as though China doesn't have enough of its own architects to take care of business. As LDY principal Ken Yeang points out, whether they operate within the remnants of the vast municipal architecture institutes or as part of the burgeoning private practice scene, China has many excellent architects, most of them trained at the best UK and US architecture schools.

However, Memphis, Tennessee-based practice TRO Jung|Brannen has made inroads here. Its relationship with the region goes back some 15 years, when a young Chinese graduate intern, Kai Wang, first suggested sharing the practice's healthcare knowledge with China's medical fraternity at various seminars. Wang is now running its office in Beijing. TRO Jung|Brannen's first project was the 600-bed, 60,000 square metre Shanghai East Hospital, which had to be constructed in three phases, on the same site as the existing hospital, to keep the building operational throughout.

Completed in 2000, the 500 bed Tianjin Children's Hospital is one of a number of innovative hospital designs in China by TRO Jung|Brannen

East meets west

Keen to incorporate the best of Western practices with those of the East, TRO Jung|Brannen had to accommodate many cultural differences. Principal David Rhodes says: "In China the hospital is the centre of all healthcare. People come there for everything – treatments, checkups, visits to all outpatient clinics. So we had to accommodate large volumes of people. We put in big windows, and were able to bring a lot of daylight into where the diagnostic clinics and outpatient clinics were.

"In China there is a strong preference for all patient rooms facing south. So how do you come up with a scheme that accommodates that, but doesn't walk the nurses to death? We actually created two nursing units, on each floor, side by side. The rooms stretch out along a semi-circular wing. The north side has all the

Dongtan City: An eco-exemplar

Client: Shanghai Industrial Investment Corporation
Masterplanning and sustainability guidelines: Arup
Size: 86 square kilometres
Completion date: Linking bridge will be completed by 2009

support facilities – staff quarters, lockers – and that keeps them away from all of the patient facilities."

Since then, most of TRO Jung|Brannen's projects have adapted this model, with southeast-facing patient rooms, natural, in-room ventilation and air conditioning only when absolutely necessary. There is strict separation of clean and soiled materials – even separate lifts.

As we know, China has a long and proven medical history of its own, and most patients these days receive both traditional Chinese and western medicine. "All the hospitals we have been in have acupuncture and traditional chinese medicine, with its own pharmacy that involves the cooking of herbs, with very strong smells. We separate that from the western pharmacy and exhaust them like a kitchen.

"In China there is more sensitivity to the (need for) daylight, more emphasis on what the patients see when they look out of the room, rather than opting for the most efficient design. We have waiting rooms with atriums, and patient recovery rooms must have outside windows." Only radiology, surgery and laboratories are windowless.

Room size is still an issue. Says Rhodes: "We've been convincing them to follow US minimum guidelines, which is much larger than they are used to. It's been a bit of a compromise. They'll often add in extra beds. Most of the jobs we've done have had four-bed wards. Most of them have been semi-private. In one case we designed for four beds in each room, and they put in six.

"It's evolving. You have this emerging middle class in China that is looking for higher standards. Even though the public system is what they are using, they are willing to pay for a bit of privacy."

But it has to be said, these new, improved hospitals are still in the minority, and only the big municipalities have the budgets to commission them.

Dongtan City: An eco exemplar

Dongtan is planned as a development of three villages that join together to form a city centre. It is designed to run entirely on renewable energy for its buildings, its infrastructure and its transport needs and will recover, recycle and reuse 90% of all waste in the city, with the eventual aim of becoming a zero-waste city.

Arup's masterplan includes a combination of traditional and innovative building technologies which will reduce energy requirements by around 66%, saving an estimated 350,000 tonnes of CO_2 per year. It is designed so that all housing will be within seven minutes walk of public transport and with easy access to social infrastructure such as hospitals, schools and work.

Dongtan will produce sufficient electricity and heat for its own use, entirely from renewable sources, including wind farms, biogas (extracted from the treatment of municipal solid waste and sewage), and photovoltaic cells and micro wind turbines sited within buildings. There will be practically no emissions from vehicles – vehicles will be battery or fuel-cell powered. A combination of cycle-paths, pedestrian routes and varied modes of public transport, including buses and water taxis, will be provided to circulate citizens around the city.

Susan Francis of the UK's Commission for Architecture and the Built Environment (CABE) visited Beijing, Shanghai and the surrounding countryside on a recent trip organised, during the Olympics, by the Royal Institute of British Architecture (RIBA). Her impression was that of a country in the process of "an obliteration of a culture and a bringing in of the new". Of great concern to her, from a health perspective, was the fact that rural areas – which still constitute the vast bulk of China's landscape – are seemingly left in the dark ages, while the cities advance at warp speed.

Rhodes agrees: "District and county hospitals are in a real dilemma. They are barely buildings. There are naked light bulbs hanging from the ceilings, and no heat or air. For the country to leap from that to what we are doing is really inconceivable."

Shenzhen Bin Hai

Cost: 7,000 RMB/m^2
Client: Shenzhen Healthcare Bureau
Architect of Record: Shenzhen General Architectural Design and Research Institute
Design Architect: TRO Jung|Brannen
Structural Engineer: Shenzhen General Architectural Design and Research Institute
Landscape Architect: To be determined

Which all adds up to a model of work and lifestyles that are far from green. But China is taking note of green concerns. Arup, heavily involved in the engineering and design of many Chinese cityscapes, has drawn up the blueprint for the futuristic, and as yet unbuilt, eco city of Dongtan, which will be constructed on the southeastern tip of Chongming Island, Shanghai.

Head of global healthcare Phil Nedin says: "The trouble with this area is high humidity. That doesn't help us when we're seeking low carbon solutions. But we are looking to incorporate openable windows, natural ventilation wherever possible. Healthcare design is very prescriptive, but we are trying to be as open-minded as possible. We are looking at the idea of a labyrinth (cooling and ventilation system) in the basement area, exposed concrete and high ceilings."

However, the scheme has yet to attract sufficient backing to begin construction, and it's notable that Arup has not exposed itself to the healthcare sector in China, yet. But things move fast in China.

A year ago, Steffian Bradley Associates CEO Kurt Rockstroh was turning down healthcare work in the region, partly because "the majority of these projects are very parochial in their approach. They are trying to bang out a lot of hospitals to cater for large numbers of people. But it is opening up. There are a few well thought-out projects that are designing for the future and better models of care, and as people see how much better that is, they will begin to demand it."

Veronica Simpson is an architectural journalist and writer

Shenzhen Hospital

Shenzhen Hospital, at 2,000 beds and 3,000m^2, is the largest healthcare project TRO Jung|Brannen has ever designed. On a greenfield site, it has a 30m height restriction, "so it's spread out the length of almost two soccer fields," says principal David Rhodes. "We have organised the project into clusters of services, cardiac and inpatient, outpatient clinic, diagnostics and separate treatment." The buildings are all connected at the basement and first-floor level, with bridges at three levels above, connecting the outpatient clinics and inpatient towers to the central diagnostic and treatment block. The three buildings on the north side of the site have second floor bridges for staff access to the hospital. There are shared facilities for food, pharmacy, laboratory and other central services. The 'hook'-shaped wing at the southeast corner of the site is a 300-bed VIP facility with many of its own diagnostic and treatment facilities and support functions including extensive wellness and rehab spaces.

Given the low rise, and dispersed nature of the buildings, there are multiple opportunities for lush planting, and botanic gardens are planned between the hospital and the adjacent coastline. All parking is underground, minimising road traffic and, unusually, all the patient rooms have open balconies facing the south and the sea. This is something TRO Jung|Brannen wouldn't be allowed in the US, for health and safety reasons, but will undoubtedly make for a delightful patient experience. The central 'mall' between the outpatient and diagnostic/treatment block is covered and partially enclosed to take advantage of the moderate climate. The enclosed part can be air-conditioned but not heated, and the covered area allows for ventilation without air conditioning. Green roofs will be provided over the D/T block and used as outdoor gardens for the inpatient units. The outpatient building utilises interior courtyards to allow for natural light and ventilation.

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Saint Francis Tulsa Children's Hospital, Tulsa, Oklahoma

Photography by Gary Kessel





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Hangzhou District Hospital

In the lakeside city of Hangzhou , TRO Jung|Brannen has created plans for a new district hospital for the Hangzhou municipal government, with 1,200 beds with 152,000m^2. Won as part of a design competition, the mayor specifically wanted to see this facility as a significant piece of architecture. It's on a clean site with water features.

The materials in the rectangular block are primarily stone, similar to that found on many buildings in Hangzhou, fronted by a bow-shaped glass structure. All outpatient clinics and most of the diagnostic and treatment functions are located in the rectangular block, separated from the bow-shaped structure by a central atrium/mall. All waiting rooms open onto the mall. Bridges above the first floor are used to transport inpatients across to the D/T facilities without going across the first floor of the mall.

A two-level basement connects the entire structure and provides strict separation of clean from soiled traffic. A separate building houses the administrative, education, and research activities including staff dining and kitchen. There is a green roof over the D/T block, and underground parking to maximise green areas and water on site.

Hangzhou Bin Jiang

Cost: 4,200 RMB/m^2
Client: Hangzhou Healthcare Bureau
Architect of record: Hangzhou Architectural Design and Research Institute
Design Architect: TRO Jung|Brannen Design
Structural Engineer: Hangzhou Architectural Design and Research Institute
Landscape Architect: To be determined

Eastern promise

The modernisation of healthcare facilities and reform of the healthcare sector is gaining pace in Russia and Eastern Europe. *Kathleen Armstrong* looks at recent developments and the challenges and opportunities they provide

It has been 17 years since the collapse of the Soviet Union, but it is only now that the rebuilding of the healthcare sector in the countries of the former USSR and Eastern Europe is really beginning to get under way. Years of neglect have left buildings in a poor condition, impacting on patient care. And as they look for ways to modernise, architects and construction specialists from around the world are looking at how they can get involved.

During the Soviet era, health was not a priority and investment was low. At the same time, there were large numbers of small hospitals. The primary care sector was relatively undeveloped, hospitals were often disease-focused and there were parallel health systems for specific sectors, such as the army, the police or transport, each with their own set of hospitals and medical care.

In the USSR, funding was focused on bed numbers rather than the care provided. This, says Bernd Rechel from the London School of Health and Tropical Medicine, led to unnecessary hospitalisation and an inefficient use of resources. In its 2004 report on healthcare in the Ukraine[1], the European Observatory on Health Systems and Policies said: "Despite the limited resources available for the healthcare system, planning continued to be oriented towards the goal of ever-increasing capacity, measured by the number of hospital beds and of health personnel. As a result, Ukraine, as many other former Soviet republics, had one of the world's highest numbers of hospital beds and physicians per capita. Inevitably, increased quantity was at the expense of quality, and in many cases encouraged harmful practices such as lengthy hospitalisations for minor disorders."

Under-investment in facilities meant that some hospitals in rural areas didn't even have basic amenities, such as running water or sewerage[2].

After the fall of the Soviet Union, most of the countries in the former USSR and in Eastern Europe fell into a period of economic decline and, as a result, healthcare suffered further. In Russia, the "worsening economic situation in the 1980s and 1990s led to a slow deterioration in services, as equipment became antiquated or needed to be replaced, drug stocks dwindled and the fabric of buildings decayed"[2].

A mixed story

Countries in the region are now stepping up investment in the sector. Funding is most secure in Russia and Kazakhstan who are reaping the benefits of the oil boom and, therefore, have more funding available

Medicover Hospital, Warsaw

Cost: approx £13million (at 2006 prices)
Client: Medicover
Lead Consultant: Arup
Architect: Nightingale Associates and Atelier 7
Health Planners: Tribal
Structural Engineer: Arup
Services and Environmental Engineer: Arup
Quantity Surveyor and Planning Supervisor: Arup
Landscape Architect: Atelier 7

to invest in new facilities. However, for other countries in the region budgets are more insecure and progress has been slower.

Funding to support infrastructure development has come from a range of sources, including the European Union, the World Bank, the Islamic Development Bank and the World Health Organization. However there are many other areas of infrastructure in each of the countries that desperately need attention and are also laying claim to the funds, so resources are limited. So, many countries in Eastern Europe and the former Soviet Union are now looking to the private sector as a way to fill the gap.

In Romania, the government announced plans in May 2007 for the construction of 20 country emergency hospitals and eight regional hospitals[3]. Procurement procedures for the facilities were originally planned to be finished a year ago but they have only recently been completed. Once construction begins, the government says they will be completed in 18 months.

In Bulgaria, there were only 18 hospitals in the country in 2000. By 2007, there were 71 new hospitals and another 80 are expected to have opened by the end of 2008[4]. The government has a policy of public-private partnerships and at the beginning of this year approved the full privatisation of hospitals.

Swissmed Hospital, Gdansk

Cost: 70.000.000,00PLN
Client: Swissmed Centrum Zdrowia
Lead consultant: ARCHstyl Maria Podwojewska
General Contractor: POLNORD
Architect: Watkins Gray International LLP
Construction Management: Jacek Swigost
Landscape Architect:
ESTA Jolanta Bogucka-Delezuch

The WGI-designed Swissmed hospital in Warsaw, currently under construction

Georgia has also privatised its healthcare sector and all but four of the 254 state-owned hospitals have now been taken over mainly by healthcare and real estate companies, on the proviso that they will be refurbished and will not be converted to any other use for a period of seven years. According to a report in *Pharma & Healthcare Europe*[5], fewer than 30% of the country's 16,455 hospital beds are currently in use and the government is aiming to eventually reduce the number of hospitals in the country to 100, restructuring healthcare to a system with less specialised and more general hospital care.

Private inroads into Poland

In Poland the switch to private healthcare is also well under way. Construction of the first private hospital since EU accession began in June 2007 with €30m investment from medical services company Medicover. Colin Hockley, managing director of Nightingale Associates which designed the facility, said the hospital

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is targeted at "the inhabitants of Warsaw and other insured customers". Nightingale's health development director Kieren Morgan said the building is designed to be noninstitutional, in contrast with existing state provision. Medicover wanted the hospital to provide a welcoming atmosphere and exude clinical excellence. The design also had to incorporate flexibility to allow for eventual expansion.

Polish architectural firm Atelier 7 took over the technical design of the project to ensure that it met local regulations – it was a requirement of the Polish government that a local firm become the 'legal author' of the development.

Hospital wards in Poland, Morgan said, are often self-contained entities, each with its own facilities. The Medicover hospital, however, will be structured more around international models, with a separate operating theatre department and diagnostics that cater to the whole hospital rather than an individual ward.

The Swissmed general hospital in Gdansk is another response to the perceived need for private healthcare. Designed by WGI Architects, the 75-bed hospital will cater mainly for international companies who provide private health insurance for their employees. The design includes natural light and healing gardens, incorporating many of the values of evidence-based design – a movement that has yet to take a real hold in countries with emerging economies like Poland where trying to find ways to fix basic infrastructure and crumbling architecture on very limited budgets is more of a priority.

The Gdansk facility was constructed before Poland's accession to the European Union (EU), opening in January 2004, and WGI is now designing two further hospitals for Swissmed – one, a larger modern hospital in Bratslav and the other in Warsaw.

The 16,631sqm Medicover Hospital in Warsaw brings UK and Polish design standards together in a modern facility

WGI partner Chris Pye said the design had to include enough space in patient rooms for visits by relatives and extended family, as well as the development of mixed-use hotel-type accommodation adjacent to the hospital that could be used by patients' families and by passing trade.

State hospitals, Pye said, are often impoverished and crumbling, badly in need of repair. At the same time, there is a growing middle class in the country who are willing to pay for a higher level of care and access to better facilities.

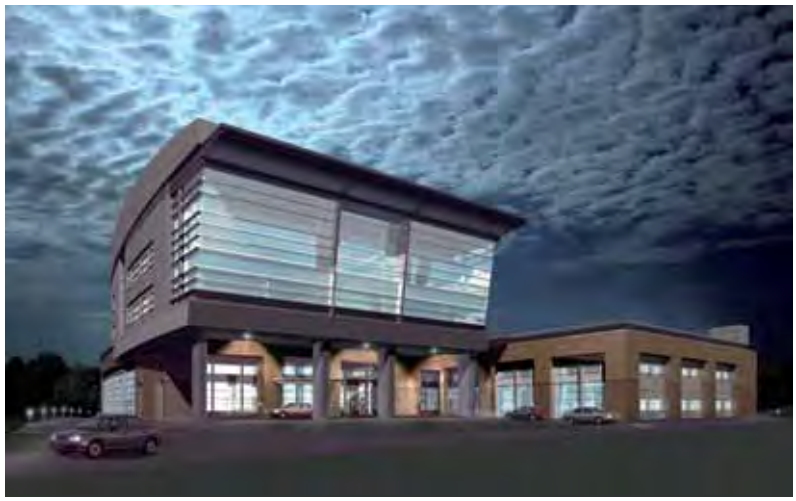
Russian regulations

It is a similar situation in Russia, where the private sector has also begun to take hold. However, the process of complying with regulations, especially for projects that move beyond the traditional, can mean projects are delayed, often for extended periods of time. And for non-Russian architectural firms and other companies wanting to design and build facilities that go beyond the norm, it can be a steep learning curve.

Up to now, much private sector development has focused on small private clinics retro-fitted into existing buildings. But a number of commercial developers are planning more ambitious projects, large hospitals that will offer a full range of care.

When planning first began for CMI Development's Moscow Medical Center, the aim was to become the first 'western-style' hospital in the country. The standalone facility was designed by NBBJ Architects in Columbus, Ohio who began working on the project in 2002.

Architect Tim Fishking said one of the main challenges



Moscow Medical Center

Project Cost: $95m
Construction Cost: $75m
Client: CMI Development
Architect: NBBJ (Columbus, Ohio office)
Structural Engineer: Korda Nemeth
Landscape Architect: NBBJ

ideas that heal. places that perform.

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Clockwise from top: Southwest Washington Medical Center; The Sail at Marina Bay, Singapore; Healing Garden, Swedish Cancer Institute; The Wellcome Trust, UK

was to learn how the regulatory process worked, how to successfully marry international best practice with Russian regulatory requirements. English translations of the regulatory requirements – the SNIPS and norms – were difficult to obtain and trying to get approval from the regulatory authorities for standards that were outside the Russian norm was often difficult. To help facilitate the approval process, CMI Developments brought representatives from the regulatory agencies to the US, to visit facilities with a similar vision.

The standards that were the main sticking points, Fishking said, were related to the physical architecture – such as plumbing, quality of air, power and water. Eventually, approvals were given and construction on the project began. However, construction came to a halt when many of the approvals that were verbally agreed were reversed, and it remains only partially complete. Whether it will be used in the end for healthcare or put to some other use, he is unsure as NBBJ is no longer involved in the project.

Fishking said NBBJ learned a lot from the process, which it will not only apply to future projects in Russia but some of which it is also applying to projects in the US, including standards which Fishking originally thought were old-fashioned but learned to appreciate during the process.

Penza Cardiology Centre, Russian Federation

The 19,000m^2 cardiology centre in Penza in Russia's southwestern region includes a three-storey main building and four-storey Y-shaped wing. Large expanses of glass and colours give structure to the building's varied exterior. Facilities in the 185-bed unit include three operating theatres, 40 intensive care beds and two angiography rooms. It is one of 14 modular facilities constructed for the Russian government by Cadolto, which have been developed to meet the needs of local populations, according to assessments carried out by the government.

The process was smoother for Cadolto, which worked directly with the Russian government on the construction of 14 specialist medical centres around the country. The company, which specialises in modular buildings, had a tight deadline in which to deliver the facilities but chief operating office Dr Björn Werner said the ability to provide a quick turnaround was one of the reasons why modular construction was chosen for the projects.

Constructed in the Cadolto factory, when they leave to be transported to the site, they include all medical, laboratory and building technology, sanitary installation, tiles, fitments, equipment, as well as the façade of the building.

Initial discussions about the project first began in 2005 and the first seven fully equipped pre-fabricated modules, each of around 19,000m^2, had been delivered by June 2008. The remaining seven are due to be ready for use sometime in 2009.

The facilities will comprise traumatology centres in Krasnodar, Cheboksary, Smolensk, Barnaul and Vladivostok; cardiosurgery centres in Chabarovsk, Krasnoyarsk, Astrakhan, Penza, Kaliningrad, Perm and Chelyabinsk; and neurosurgery centres in Tyumen and Novosibirsk.

The modernisation of healthcare facilities and reform of healthcare delivery throughout Russia and Eastern Europe is gaining momentum. Canada's Zeidler Partnership is in the initial stages of discussion about the design of another new private hospital in Russia and WGI, NBBJ, Nightingale and other architectural firms are exploring opportunities in Romania, Hungary and other countries of Eastern Europe.

The challenges remain high, but the opportunities are great.

Kathleen Armstrong is a health writer

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Concert of care

Eve Edelstein visits Palomar Pomerado Health to see how the US healthcare provider is integrating leading-edge medical and information technology into its design for the hospital of the future

As hospitals grow ever larger and care serves an increasingly acute patient population, a new range of technologies is being sought to enhance care and transmit medical information within and beyond hospital walls.

This movement explores systems that function simultaneously at internal, individual and global levels. Information technology and microelectronic systems are being developed to transmit patients' vital signs and physiological states so that triage can occur before the patient reaches the hospital, at the same time as enabling access to medical expertise around the globe.

As scientists develop microtechnologies that monitor the health status of people in the most extreme environments, whether in space flight or on the battleground, we can expect to have these technologies trickle down to our homes and public places. In hospitals, it will enable timely and continued logging of patient status that can be accessed by caregivers on site and remotely.

Hospital of the future

Palomar Pomerado Health (PPH) in Southern California is looking to incorporate such technologies, building an innovative healthcare system for the seven communities and outlying areas it serves in northern San Diego County, the largest public health district in California.

With expenditures of approximately $1.2 billion, PPH will build a hospital of the future, a 450-bed tertiary medical centre that will replace its current hospital in downtown Escondido; double the size of its second hospital in Poway to more than 200-beds; seismically retrofit and convert its existing 326-bed hospital in downtown Escondido into a specialised campus featuring mixed-use retail, housing, physical rehab, urgent care, behavioural health, oncology services and administrative offices; and build four major satellite health centres throughout the health district. These plans are driven by its projection of at least a 30% increase in population with a doubling in the number of those over the age of 65, and an unfunded state mandate that requires acute care facilities to meet earthquake standards.

The stated goal of Michael Covert, president and CEO, is to "build the Fable Hospital" described by Berry *et al*[1], to increase operational

efficiency, reduce errors and injury, build in flexibility, and improve the contribution of architecture to a healing environment. "Throughout this process, we needed to remind ourselves repeatedly that we are not building with today's technology in mind or even for the innovations of 10 years from now," Covert said.[2]

PPH's process includes evaluations of cutting-edge technologies, including operating suite robotics, remote medical presence via roving consultation robots, personal RFID tracking devices, high-tech patient beds and automated systems that monitor patient health status and movement, LCD image and information panels in each patient room, and patient rooms that can be quickly reconfigured to support rapidly changing patient needs and advances in medical procedures.

Shed burdensome heritage…come from nowhere; change the game; innovate; and act

The innovation challenge

A conflict arises when selecting information and high-technology solutions for healthcare environments. Technological innovations and developments occur at a pace that is more rapid than the architectural process. By the time a healthcare facility has been planned, approved, and built, several new generations of technologies may have been tried and tested.

To meet this challenge, Orlando Portale, PPH's chief technology and innovation officer, uses an approach borrowed from systems design philosophy: "Shed burdensome heritage; put everything on the table; come from nowhere; fail early and small; embrace constructive dissatisfaction; change the game; innovate; and act."

This approach considers not only products readily available today, but also looks to future systems at the 'bleeding edge' of technological innovation. This process builds a view of the future that can be used to formulate more informed and educated guesses about changes in architectural infrastructure. Finally, the PPH strategy may include a delay of technology purchases until the last practical moment, so that innovations can be incorporated when the hospital opens in three years.

The nature and risk of healthcare provision poses additional challenges that arise when choosing technologies. The margin of error for medical technologies must be extremely low. An error rate of one may result in one death or multiple injuries. However, old systems impose their own risks. Portale suggests that they can be inefficient; at worst, deadly, including errors in surgical orders, medication dosage or follow-up care.

Testing technologies

Updated information technologies and operational systems are thus being sought to reduce the vast amounts of information permanently lost because of outdated or poorly conceived information transfer and management systems. Critical to the successful implementation of any new system in a complex, high risk environment such as healthcare, is the testing of technologies by interdisciplinary planning and care teams in clinical units during real-time, real-world healthcare operations or in mock-up conditions.

PPH chief nursing executive, Lorie Shoemaker, recruited staff from across the hospital to participate in a user assessment of design concepts and to test some of the technologies on its units. For example, remote tele-presence is being explored in Pomerado's intensive care units, using internet and video conferencing via the InTouch Health Kodak camera to review patient results from scans and images.

A novel mobile robot is being tested as a means to provide remote medical presence in several clinical areas.

The terrace at the Palomar Pomerado Health's 'Hospital of the Future'

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Dubbed 'Iris' because it functions as another pair of eyes, the robot rolls through units and patient rooms, controlled remotely by doctors using a joystick and laptop. Via a high-speed internet connection, the robot allows remote consultation with colleagues, patients and visitors, as if the doctor were in the room. The robot, developed by InTouch Health, can navigate down hospital corridors, rotate 360 degrees, zoom a camera in on a patient's eyes, or view x-rays or vital sign monitors.

High-technology patient bed monitoring units add to the armament of high-tech devices that support continued monitoring of patient status and needs, supplementing visual surveillance by nurses. The LifeBed, produced by Hoana, uses a non-invasive 'smart' fabric on top of the bed to record vital signs, pulse, breath rhythm, heart rate and respiration without any connection whatsoever. Hoana's technology transforms any hospital bed into a LifeBed. If the patient begins to deteriorate, the LifeBed immediately notifies the hospital nursing staff. Changes in a patient's condition identified early, may result in early interventions and positively impacts patient outcome. LifeBed, reports some hospitals, have reduced falls by as much as 90%.[3]

The robot rolls through units and patient rooms, controlled remotely by doctors using a joystick

Cisco Systems has developed RFID bracelets that will guide patients. Encoded on the band is the patient's name, date of birth, gender and a medical record number, linked to the hospital network that connects the patient record to labs, billing and to the pharmacy.

Doctors and nurses will be equipped with a tablet-style PC with an RFID reader and a Wi-Fi connection to access the network. The system consists of an integrated RFID application, developed by Siemens Business Services (SBS), which connects the hospital's electronic medical records, lab systems and billing system. The existing computerised physician order entry system allows for a seamless RFID implementation. Tablet PCs are embedded with SBS RFID software and used as hand-held readers for RFID wristbands provided by Precision Dynamics Corporation (PDC). PDC's Smart Band RFID wristbands include a 13.56 MHz RFID inlay from Texas Instruments[4].

RFID systems linked to sinks are being considered as a method of alerting clinicians with the sound of an alarm as they enter a patient room to encourage them to wash their hands before contacting the patient.

Patient room design

Patient rooms for the new hospital have been designed as flexible acuity rooms, based on concepts described by Hendrich *et al*[5]. A mock-up has been built for user feedback, demonstrating improvements in surface finishes, headwall design, family zones and accessible shower rooms that add to amenity and patient comfort. The square footage of each room has been expanded from 140 square feet at the present facility to approximately 350 square feet.

Hendrich *et al*[5] reported a decrease in errors and injuries related to the reduction in patient transfers in acuity-adaptable rooms, and improved flexibility of use. Their comparison of pre- and post-patient room conditions revealed that as patient transportation was reduced by more than 90%, medication errors decreased by 70% and the fall index for patients in the high-risk cardiac test population fell from six to two falls per 1,000 patient days. Palomar will track such outcomes, as well as metrics that include costs, quality of care and patient satisfaction in flexible acuity rooms compared to the previous designs. Palomar is modeling scenarios with government regulators and collaborating with an advisory group to ensure that nurses and ancillary staff are appropriately trained for this new nursing model.

Palomar Pomerado Health's new hospital on site and under construction

The patient room has also been adapted for information systems. As physicians make rounds, large LCD panels in each patient room will provide the means to concurrently display patient demographics, vital signs and medical information. Patients will be able to remotely control room temperature, order a meal, surf the internet, conduct videoconferences with their doctor, and play music. Patients may also display images, family photographs and possibly works of art from the Museum of Modern Art.

Voice-based fall alarms will not only

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alert nursing staff to fall risk but also speak to patients using voices recorded by loved ones, gently instructing them to return to bed. Initial pilot studies in functioning clinics were successful, and 51 units have been rolled out in operational units. Ceiling-mounted patient lifts will be installed in all patient rooms, in addition to handrails leading from the head of the patient's bed to the toilet in order to minimise preventable falls. Patient rooms are organised into nursing pods with both central clinician stations and distributed nursing stations, providing continuity of care by maintaining good lines of sight between nurses and patients. The hospital plans to track patient, staff and economic outcomes relative to such design changes.

Community engagement

In 2004, seeking broad input from the community, a virtual Palomar hospital was launched on the internet, offering visitors a reproduction of the proposed development. Developed by Linden Labs, Second Life visitors can tour the site in the form of avatars, moving through simulated models of the facility and learning about proposed technological innovations. Second Life enables a unique opportunity for involvement with an audience. Unlike most traditional web sites, this virtual world platform encourages high engagement.

Other organisations have taken advantage of this 3D interaction space to conduct research and solicit feedback[6]. Palomar will use this vehicle to model how architectural design and technological interventions may influence workflow[7].

What becomes clear from both virtual and mock-up visits is that technology and architecture must work in concert. As the fulcrum of activity in emergency situations, healthcare spaces must remain functioning despite loss of energy or communication bandwaves.

Although backup electrical generators are required, care provision must continue despite their failure. Therefore, architecture must provide adequate sightlines to patients and other staff, and create spaces for communication in verbal and written form as well as remotely.

Accordingly, hospital design must facilitate multiple electronic transfer systems and allow for innovations to be incorporated with minimal physical change. At the same time, hospital design must support the transfer of information from person to person, encouraging information carried in the expression of urgency seen in the eyes above a surgical mask, and the transfer of knowledge and caring provided by face-to-face encounters.

Dr Eve Edelstein MArch, PhD, Assoc AIA, F-AAA is senior vice-president of research and design at HMC Architects and a visiting scholar working with the California Institute for Telecommunications and Information Technology (Calit[2]) at the University of California, San Diego.

Above Top: Patient rooms have been designed as flexible acuity-adaptable environments

Above: Large LCD panels in each patient room will provide patients and physicians with the means to concurrently display patient demographics, vital signs and medical information

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A sense of home

Seating from the new Knightsbridge Mental Health Furniture collection is helping to establish a therapeutic environment within a pioneering new mental health complex in Leicestershire, UK.

The Herschel Prins Centre is a specialist low-secure facility run by Leicestershire Partnership NHS Trust. Furnished in line with an ethos of accessibility and homeliness, the centre ensures an ambience which encourages both respect and courtesy from patients and regular visits by their friends and families.

Working closely with the project team, the Knightsbridge team helped to develop colour and design stories which engender a positive and therapeutic response. Woodwork is a light shade of natural beech and fabrics coordinate with the artwork which adorns the walls of every room. Yet all the furniture retains its suitability for use in challenging mental health environments: within patient areas, for example, non-retractable screws have been specified to avoid the risk of patients self-harming.

Seating from the Knightsbridge Mental Health Furniture collection

Visitors to the centre are greeted by smart Melrose club chairs and twin-seat settees in luxurious red hide upholstery, an elegance matched in the dining rooms by chairs from the Knightsbridge Elliot and Katrine collections in shades of cream and navy faux leather. In the family areas and faith room, a more informal atmosphere is enhanced by the curved profile and soft covers of Bugatti easy chairs and settees, whilst patients and visitors can enjoy the comfortable low-line Byron armchairs in the lounges, where practical loose covers feature a diversity of designs.

Owen chairs are co-ordinated with individual themes in clinical and administration sectors, while offices are equipped with Harris visitor seating, complemented by Nimbus armchairs in meeting rooms and in the staff room.

www.knightsbridge-furniture.co.uk

Wake up, it's a beautiful morning

The Philips Wake-up Light 2008 is designed to evoke a feeling of sunrise with a steadily increasing light intensity emanating from the light itself.

Smaller than previous dawn simulators, and with a more user-friendly interface and new materials, the iconic lampshade offers a contemporary aesthetic and more modern design that integrates seamlessly with its environment. Combining a reading lamp with an alarm clock, the new Wake-up Light offers a more pleasant way to wake up, by gradually illuminating as it turns on to simulate a sunrise and follow the natural rhythm of the body.

The Philips' Wake-up Light

This is further enhanced by the diversity of alarm sounds to choose from to accompany the waking experience – from sounds derived from nature to a gentle, ambient waking alarm. Once fully illuminated, the lamp recalls a sunset on the horizon as it shines over the divider that sits between the luminescence and the dark part of the device.

www.philips.com/simplicity

The 'Richmond' collection of fabrics by Panaz Healthcare

Classic styling

Classic styling and essential practicality are claimed to be the key features of a new concept in flame-retardant fabrics, created by Panaz Healthcare.

Designed for care homes and supported living environments, 'Richmond' comprises a harmonious balance of formal and freehand florals complemented by subtly coordinating trails, toning stripes and fine checks. 'Richmond' also features a series of spirited colour stories. Fuchsia sits with soft Sage, Aqua with rich Chocolate, Mulberry with Olive and Citrus with Henna in an array of distinctive palettes.

For 'Richmond' drapes, bedcovers and accessories, a supple linen-effect basecloth has also been created by the Panaz development team, combining the appeal of a natural handle with durability and high performance, fire-retardant characteristics.

www.panaz.com

Natural rhythms

Inspired by the healing benefits of nature, coupled with simple symmetry and modern abstracts, Secret Garden, the latest creation from Mosaic by Skopos, is a relaxing and rejuvenating collection ideally suited to enhance a variety of healthcare interiors. Secret Garden has been created from a desire to work with nature's own rhythm and the known benefits nature can have on an individual's recovery rate. Such holistic benefits may include relaxation, stress reduction, decreased mental fatigue, restored mental clarity and an increased sense of wellbeing.

As a versatile and contemporary collection, consisting of seven serene and tranquil designs across an invigorating and uplifting colour pallet, Secret Garden is designed to work either as complementary pairs or as individual pieces to help create a sense of wellbeing and calm. Notable design points include expressive organic forms, fluid waves and chambers of colour, all of which can be seen to reflect elements included within modern complementary medicine.

All Secret Garden designs are printed on 100% polyester and are inherently flame-retardant, in addition to being fully washable to 71˚C for thermal disinfection. Secret Garden is suitable for a variety of applications including: cubicle curtains, window curtains, counterpanes, and bedspreads.

www.skoposdesignltd.com

Secret Garden, from Mosaic by Skopos Design

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In our daily lives we are often so busy and preoccupied that we don't see obvious every day things in front of our eyes. We pass a particular store and don't notice the shop window has been changed, and we sit in our favourite chair without noticing that it has been cleaned for the first time in years. These things pass unnoticed – until someone points them out!

That's what evidenced-based research in the built environment can do for us, as is the case with this issue's articles. Shopping in a crowded street market, women having babies, and looking out a window at an ocean view are some of the every day events in which the built environment can impact on our health and wellbeing.

Akers and Akers' careful multi-method study of the health implications of selling vegetables and other household goods on crowded sidewalks in Baguio City, Philippines makes us take a second glance at all those who work outdoors in crowded cities. It is now de rigueur in New York City to have a gyro sandwich and fruit shake on the corner for lunch. In Bangkok, food and knock-off clothing vendors line every downtown sidewalk.

This study also demonstrates how important it is to analyse environments carefully when drawing conclusions – the width of the sidewalk and the slope of the street in this example – and to employ the most appropriate method for each dimension.

Forbes, Homer, Foureur and Leap carry out a similarly careful study of places for birthing. If birthing at home is so much more comfortable and natural, they posit, we ought to design hospital environments for birthing that have the same supportive characteristics. Their design recommendations include such subtle elements as the flow rate of bath water so that the water can be heated up quickly for comfort, and location of the bath against a wall so that mothers feel less "on display".

Jones and Manighetti, in part of their research, examine the every day action of looking out of an office window – something we do many times a day. But are we aware of what we are looking at, how one view differs from another, and how that view affects our wellbeing? I seldom am!

Their final hypothesis focuses on what it is that makes views of nature so engaging and health promoting. What they conclude is that it may well be the colours – is it "nature" that makes us feel better or the colours blue and green?

All in all, evidence-based design research does more than just give us design guidelines; it helps us wake up to our surroundings. For this I am thankful.

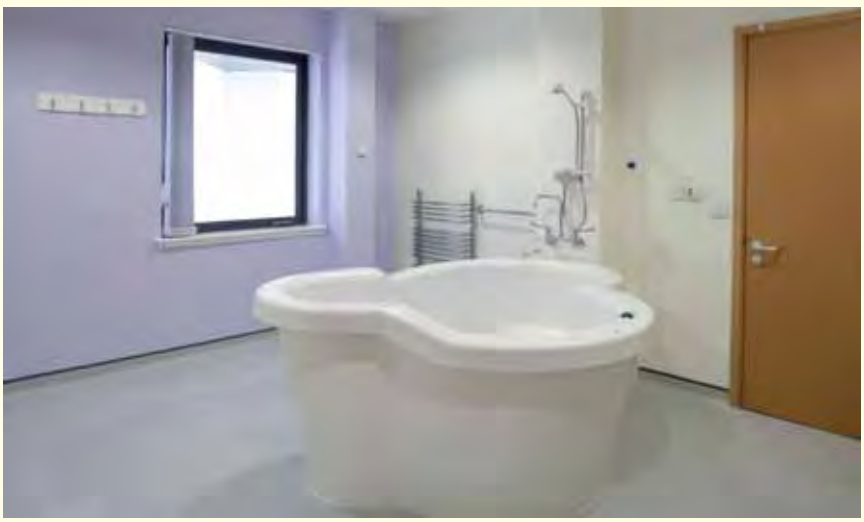
Keppie specialised in hospital buildings before the UK National Health Service (NHS) was founded, and has been at the forefront of healthcare design ever since. From the beginning of Public Private Partnerships in 1994, the practice has been unique in splitting project work equally between public sector advisory roles and private sector bidding ones, helping to understand the aspirations and working methods of both sides of the partnership equation. This has led to almost £4bn of healthcare design experience, ranging from a £5m community hospital to the £300m Forth Valley Hospital on the design side, and the £600m Birmingham New Hospitals project with the technical advisor role. We piloted an exemplar design approach to defining public sector aspirations and affordable output specifications in the late 1990s. As part of our continuous learning programme, we are a main sponsor of the Design and Health World Congress.

Top & bottom left: Coatbridge Community Health Centre Bottom Right: Dunmurry PCCI Exemplar Design, Northern Ireland
Artists Impressions © Keppie Design

Birthing Unit Design:
Researching New Principles

The Birthing Unit Design Guideline developed at the Sydney's University of Technology creates a design tool that will help to optimise the birthing experience for both mothers and midwives

Ian Forbes MSc (Health Services Planning and Administration), Grad Dip Bus Admin, B.Arch, FRAIA; Caroline Homer RM RN MN, PhD; Maralyn Foureur RM, RN, BA, Grad Dip Clin Epidem & Biostats, PhD; Nicky Leap DMid MSc RM



Credit: Alan McAteer Photograph

Calming colours, in this birthing pool room designed by Keppie Design, help to set the mood

As part of an effort to modernise existing birthing facilities, many maternity units throughout Australia are currently being rebuilt or refurbished. However, in the state of New South Wales (NSW), a critical appraisal of the recently updated Department of Health Guidelines for Maternity Services revealed that they had failed to take into account a number of new developments in the area of 'caring/ healing' architecture[1,2].

These new insights, and the set of holistic design principles that stem from them, need to be considered in order to be able to optimise healing environments in care settings, especially in maternity.

Methodology

To look at the impact of birthing unit design, our research team conducted an extensive examination of the existing literature, and gathered further insights from surveys of birthing women, and in-depth interviews with midwives in clinical practice and architects in health facility practice. Using this information, the investigating team then prepared a set of principles for the creation of optimal birth spaces that are less stressful for women and more conducive to normal birth. These principles were enumerated and described in detail in a Birthing Unit Design Guideline. From this guideline an audit tool, called the Birthing Unit Design Spatial Evaluation Tool (BuDSET), was developed.

The next step in the methodology is to conduct a validation process, using the BuDSET instrument, at six selected sites for each of six birth units within the South East Sydney and Illawarra Area Health Service (SESIAHS) of New South Wales.

SESIAHS provides birthing services in a range of primary to tertiary maternity units in rural and urban settings. These units, therefore, provided the team with a range of sites, including newer, older, smaller and larger units, to enable comparison of context and setting and also to determine a baseline of compliance with the BuD principles.

Birthing context

Over the past 50 years, the design of birthing units in developed countries has focused on providing places for women to give birth in hospital environments, fully equipped with technology in order to ensure that births are safe. However, both doctors and midwives have raised concerns that medicalised hospital environments may have, in fact, contributed to the increasing rate of interventions – and in particular, caesarean sections – and the additional risks that these interventions bring[2,3].

The campaign to promote 'normal birth' conducted in 2005 by the UK's Royal College of Midwives reflects how the tide is turning against the continued acceptance of technical intervention[4]. Concerns were raised about the consequences on the health of the mother – the potential for infections, deep venous clots, longer recovery, reduced physical and emotional health – as well as the impact on children born to mothers who had had previous caesarean deliveries, including stillbirths, congenital malformation, central nervous system injury and other risk factors[3,5].

But even if interventions are being used to help ensure good outcomes, hospitals need to realise that most women do not need to give birth in physical spaces that are the equivalent of an intensive care unit.

Learning from home births

In 2004 there were only 589 homebirths reported in Australia, representing 0.2% of the 257,205 births that took place that year. There were 5,079 births in midwife-managed birth centres[6]. Despite the small numbers – which may not take some unreported births into account – it has been through the home birthing movement that change

has come. Particularly in the UK, Europe and Australia, an understanding of what women choose to do when unencumbered by a medicalised environment has become more evident[7].

Comparing the behaviour of labouring women in hospital with those who give birth at home reveals that homebirth midwives have developed a profound understanding of the important elements in non-medicalised birthing[8,9]. At the turn of the 20th century, during the move away from birthing at home, three critical elements were lost[9]:

- the opportunity to undergo labour in a familiar environment
- the close and trusting personal relationship between the woman and midwife and the continuous support that was provided by this person
- the belief in childbirth as a natural physiological event.

The 'environment' is more than physical space or location – it also takes up an emotional space in the hearts and minds of women who are undergoing labour and giving birth. This environment has a powerful influence on both the woman and the midwife. Women who are asking for home-like environments and continuity of care with a designated midwife, as well as more choice and involvement in decision-making, are unconsciously looking for the elements that have been lost from the home birthing environment[9,10].

Studies of women giving birth at home show that women respond in dynamic and disinhibited ways in response to the feeling of the baby pressing on their cervix or moving through the pelvis. Women were quiet and noisy, clothed or naked, restless or still, paced the room, rocked back and forth, sat in chairs, lay on the bed, squatted in the toilet, stood under the shower, lay in the bath, leaned over the mantelpiece, window sill or partner and chose many different locations within their homes in which to give birth[10].

This was not the experience found in hospital births. In hospital, midwives and birthing women found themselves constrained not only by the lack of privacy and the lack of accessible bathroom and en-suite facilities, but also by the only piece of furniture in the room: the high, narrow, metal bed with plastic under-sheet and ever-ready stirrups. The bed, taking up the majority of space and seeming to suggest the birth should only be on the bed, has become a major theme in the changes needed to correct the architecture of birthing spaces.

Credit: Alan McAteer Photograph

A calm environment at Aryshire Maternity Unit at Crosshouse Hospital, designed by Keppie Design

Is birthing design important?

Italian architect Bianca Lepori[10], an international specialist in birthing unit design, has raised concerns through her publications and conference appearances about poor total environments for birthing in hospitals. Especially having an impact is her recognition that poor physical environments are a major contributor to the creation of a pathological rather than a physiological place for birthing.

Lepori constrasts the positive spirit of the home birth to hospital environments, which, she believes, cause women to unconsciously accept the technologically expedient pathway laid down by the hospital birthing process. In doing this, women have disconnected themselves from the natural pathway of being present and actively participating in the birth.

Lepori says that, although technology is essential for safe birth, we have forgotten the 'soul' of the places we build – and we need to bring the battle between the technical and the emotional into balance. She uses the idea of the integration between the left and right hemispheres of the brain coming together in 'Mindbodyspirit Architecture', creating an optimally correct place for birthing to occur.

Only recently has the general public started to become aware that the spaces we build, and the environments enclosed by these spaces, have a significant impact on our health. Populist books by authors like Christopher Day (Places of the Soul, 2004[11]) and Alain de Botton (The Architecture of Happiness, 2006[12]) have extended this idea to wider audiences.

But the building itself is not the only element in the whole human environment. By concentrating on the building itself and not on the kind of place it creates, we have failed to grasp the psychosocial impact of our buildings.

De Botton[12] argues: "The significance of architecture is premised on the notion that we are, for better or worse, different people in different places – and on the conviction that it is architecture's task to render vivid to us who we might ideally be."

In other words, the places in which we undertake specific tasks will affect us in profound ways and we need to understand who we are and in what ways the environment created by our buildings is supportive of what we wish to do. The corollary to this is that in understanding

The ability to lie back, kneel or move into other positions in the birthing pool all assist during labour and birth

people's behaviour when they occupy spaces, we begin to understand how to design them better.

Christopher Day[11] notes: "All activities demand different states of being. If we are in the wrong state for the job, we feel stressed. Our environment can provide the soul mood appropriate to the situation."

Stress reduction is a critical element in supportive or salutogenic (health-giving) space design. And the relationship between stress and the physical environment has been well established in studies over the past 10 to 15 years[13].

Getting women's views

A significant piece of research conducted by the National Childbirth Trust (NCT) in the UK in March 2003[14] provides convincing evidence that not only do women believe the place in which they give birth is important for a successful birth, but they are also clear about what they need in that space.

The NCT surveyed 2,000 women who had given birth between the years 2000 and 2003. The results showed that:

- Ninety percent of women felt that the physical surroundings can affect how easy or difficult it is to give birth
- Many women did not have access to facilities felt to be essential during labour
- Most women felt a clean room with ensuite, comfortable furniture for themselves and their companion and the ability to move around were highly important
- Women wanted control of heat, light and, especially, who came into the room
- Women did not want to change rooms to give birth or to use a birth pool
- Women giving birth in a hospital were less likely to have helpful facilities available than those who gave birth at home or in midwife-led birthing centres
- Women with good facilities were more likely to have a natural birth, while women who had an emergency caesarean were less likely to have had access to good facilities.

Privacy was an essential element that came through in many ways, including the ability not to be overheard, to control those who entered into the room and to not be able to hear other women labouring or birthing.

Most women felt the hospital bed was not important as an adjustable device for different positions in labour or in birth – many suggested it be moved out of the way. The items that were considered important included: a birthing pool (although those with no experience of this were ambivalent), beanbags, floor mats, pillows and comfortable furniture. The ability to have control of lights, so they could be adjusted to low brightness levels when needed, and quietness were important to help birthing.

Unhelpful elements were: the hospital atmosphere, small spaces that did not enable movement and walking around, an uncomfortable bed that was not adjustable, open doors, being heard, toilets outside the room, and rooms that were either too hot or cold with no temperature control.

Clearly the consistency across the NCT survey, and its correlation with other research, provides a high level of confidence that the results can be applied more generally.

Humans and their environment

In order to create the kinds of spaces women need for birthing in hospitals, we must understand what women do when allowed to birth naturally and to judge the quality of that space in achieving its salutogenic objectives.

Research into the quality of architectural space and usage has proven difficult when examining 'scientific' evidence[15]. Essentially, this is because studies carried out in normally occupied spaces are hard to control for confounding variables. As Day[11] notes: "What is often dismissed as human subjectivity is the unconscious ability to synthesise many factors: however because it's unconscious, many personal preferences get muddled in."

When we come to designing better living and working environments it is with the unconscious response to space that we are concerned. As Day[11] says: "Even if nobody looks at them, everybody responds to background visual impressions. We see this visual 'mood', can talk about it afterwards, remember it for years – but when asked to draw any of it, have hardly any idea how it actually looked!"

Particularly in health facility planning, we are anxious to ensure that the unconscious effects of built space provide positive human physiological responses – principally, stress reduction. Good spaces generate positive feelings or mood through the parasympathetic nervous system. By understanding what causes the negative effects of stress and anxiety, we are able to reduce the impact on people who are using our spaces.

A format for design guidelines

Christopher Alexander[16], through his seminal work on design quality, showed that if we

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examine the whole space, and not just the elements of it, we can achieve a qualitative response that is considered pleasing, stimulating and 'good'.

Birthing Unit Design Guidelines

In order to present the findings of this research we have chosen to use the Pattern Language format developed by Alexander. He provided a formula that identified a design problem (an observable problem requiring a solution), the underlying assumption about this problem (a testable hypothesis) and the solution (the suggested way of solving the problem). The formula produces a series of 'patterns' that can be linked into a design solution – these are recognised as universal objectives for the design.

The project team have developed a series of patterns as a guide to determining the benchmark for an ideal birthing unit. These patterns form the basis of the BuDSET audit tool. In the following section, we have used Alexander's format to illustrate and describe the tendencies people have for use of spaces and it is that which drives the quality of the spaces needed in the birthing unit design.

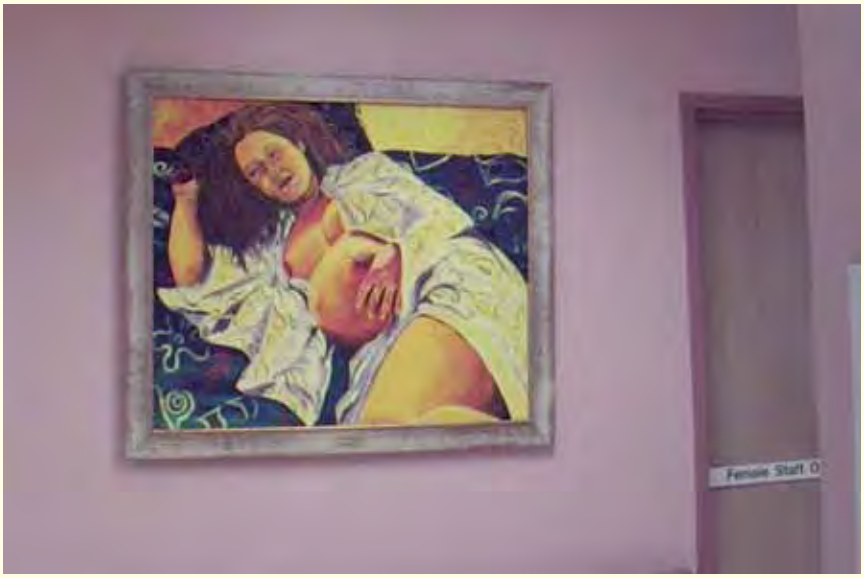
The essential starting point for this Birthing Unit Design Guideline is giving birth at home. Evidence shows that, for women who are healthy and anticipate having a normal birth, giving birth at home is ideal[17]. However, we acknowledge that in many developed countries, the proportion of women who give birth at home is small. Therefore, the birthing unit outlined in this document provides principles for the design of a health facility birth unit based on homebirth principles, listed in a sequence that reflects the progressive flow that a woman takes through the birth unit.

Access to the community

Labour and birth should happen as close to home as possible. Proximity to friends and support are essential for a healthy healing birthing experience and being a long way from home makes this difficult. Proximity to home can also be a spiritual thing. The familiarity of the birth space can reflect sufficient elements of home to reduce alienation and anxiety.

Outside access to the birthing unit

The entrance to the maternity unit must be easily identified. There should be a dedicated entry area in a general hospital facility to reduce anxiety and give confidence for a safe arrival. Entry through the emergency department is inappropriate.



Artwork helps to set the tone, providing a welcoming atmosphere for birthing mothers

Welcoming arrival

Consideration must be given to how we find and then approach the birthing unit once inside the health building. Long corridors can be frightening and cause anxiety for first-time arrivals, especially those who are not sure how far it might be or if there is help nearby. This fear is exacerbated at night when the lights are low and no one is around.

Easy wayfinding

Double doors and airlocks that are not automatic can be difficult to manoeuvre and put roadblocks in the way of hurrying or anxious people. Airlock spaces, while necessary for security, can make labouring women claustrophobic and increase anxiety. The preference is for an easy route from the outside door to a birthing unit entrance that has glass doors where staff and support can be readily seen.

Birthing unit as home

A birthing unit should be like a home. It should be possible to become familiar with the unit very quickly. Small is beautiful, therefore larger birthing units should be developed in groups or clusters that have an individual feel. Access to an outside area is important, both for enabling a view to the outdoors as well as providing potential access to nature.

The arrival hall

The public arrival area should be a transition space. We need to be able to transfer emotionally from being an 'outside person' to an 'inside person'. A space that enables this transition to take place is emotionally important. Staff should be accessible for support and direction, and the space should be as nonhospital-like as possible.

The family room

From the transition space, one should enter a welcoming shared space. This is where the family or support people, when not in the birth room can wait comfortably, occupied or asleep on a lounge. Women can share experiences and give each other support.

The mother's room

The mother's personal space for birthing should be immediately accessible from the public area. It should not be possible to get lost down corridors on the way. Corridors should be familiar and welcoming, hotel-like where room entries are highlighted in recessed openings, focused ceiling lights identify rooms and, if possible, external windows in the corridor enable orientation to the outside and the way ahead.

Privacy

The birthing woman should control the

room. An alcove at the entry can provide a place to wash hands and a cupboard for supplies before entry to the unit. The woman can see who is entering and has control over her space. The room should have an atmosphere of cleanliness and order and contain feminine symbols of beauty, wholeness and harmony.

Home comforts

Many women complain that rooms are designed around clinical procedures and the simple things, which make the space familiar and accessible, are missed[14]. There should, therefore, be a cupboard to provide adequate space for the woman's belongings. This should be designed for easy access, and for quick unpacking and repacking as women are not there for long.

Birthing pools and large baths

In the NCT study[14], the second most important feature of the labour room identified by the women as helping to facilitate their birth was access to a pool or large bath. Of those who felt this was an important element, two-fifths had not had access to a pool during their last labour. Midwives who use birthing pools say women prefer the bath not to be in the centre of a space but drawn over to one side of the room. The ability to lie in the water, hold on to a supporter, kneel, move about or sit up, all assist during labour and birth.

There should therefore be a tub bath in one corner of the room, preferably designed so that only one side of the bath faces the room and is not able to be approached from all sides – thereby not placing the occupant on display. The approach side of the bath should allow a support person or midwife to sit and assist or to remain for some time without discomfort. There also needs to be a wide edge on the wall side of the bath so the women can sit out of the bath or the partner can lean in (as shown above).

The bath must be deep enough for a woman to be on her hands and knees with her bottom submerged. Most commercial baths are not deep enough and mean that a woman must recline (lie on her back) to labour or give birth. A supine position has been shown to be counterproductive to the physiology of giving birth.

The bath must have a showerhead with a pulsing feature and the fixed rail for the shower head must be nogged into the wall if plasterboard, so the woman by pulling up can use it for support. Keeping the bath water hot is an issue and consideration must be given to allowing higher levels of temperature or faster flow rates than the normal to quickly add hot water to the bath. Spa baths are not recommended due to cleaning and infection control issues.

The birthing pool should be sufficiently deep and provide comfortable access for birthing partners and midwives

Convenient ensuite/bathroom

In addition to the bath, which becomes more of a feature of the birth room, there should be a bathroom with toilet, hand basin and shower for normal ablution functions. The studies supported by the NCT survey indicate that ready access to an ensuite toilet enables women to remain relaxed and can open up their bodies without fear of soiling floor mats or the bed.

Material support for birthing

Women will use other features in the room at different times during labour and birth. Such items include a mantle piece for the woman to lean on. Women often feel more comfortable leaning on something while standing. The mantle piece should preferably be of wood so that the texture and the appearance are domestic and have a natural feeling. Where possible, there should be tiered soft-covered benches along a wall so that the woman can lie or sit on them. These spaces are also important for the midwife or partner to rest on as well.

The woman can sit on the floor and lean against the benches, or use them to stabilise herself while squatting. They need to be covered in soft material that can be easily cleaned. Material such as floor mattresses, bean bags, balls, pulling ropes and other supports for labour and birth should be available but kept out of the room and brought in as required.

Lighting sets the mood

Lighting is critically important. In the first instance, natural light should be available and used. Natural light supports the biorhythms of the body and knowing whether it is day or night is an important orientation. Light affects mood and stimulates people physiologically as well as psychologically.

Colour builds the spirit

Careful selection of colours is important to support mood, by either stimulating with brighter colours or providing restful psychological responses with warm tones that are more subdued in colour. Small amounts of strong colour will provide stimulating vignettes but generally rooms must have less white and cream in exchange for stronger pastel colours.

Technical support

The need for medical gases and suction are fundamental to delivery, even though the focus of this guide is on low-risk uncomplicated births. Oxygen, suction and nitrous oxide should be stored behind cupboards and a service panel exposed by pulling open doors or dropping a table down. While women want the assurance of this technology, they don't want to see it.

Managing the bed

The bed in the birthing suite is important and currently bed types vary dramatically between units. Some have typical inpatient beds incorporating electronic or manual adjustments while others have fixed home-style double beds. An examination of beds leads to the following performance specification. The bed must not be the focus of the room. Too often the room has been sized with a bed in mind and little else. This means that mobility and a capacity to remain upright becomes limited. Recently, large double beds have been used in birthing suites and, while the intention is fine, this has meant even less room is available for anything other than a bed. It is preferable that the bed is pushed out of the way, for example behind the door, and the balance of the room left for multiple activities to suit the woman during labour and birth.

Most women do not use the bed when alternatives are offered. This is especially true if sufficient space is available and women are supported to remain off the bed. Some women will kneel or stand in front of the bed, some will squat using the side of the bed to hold onto, and many will give birth on their hands and knees on the floor leaning against the bed.

The bed needs to be low. It needs to move. It needs to be possible to lean against the bed when there is no other means to do so. If the woman has to use the bed, a birthing bar across the end of the bed can be used to lean against. The bed is a critical element in setting the expression and impression of the birthing room. If the bed 'screams' of technical clinical procedures then the whole birth experience will reflect this style of labour and birth.

Controlling sound

Soundproofing is required so that the room is quiet on the inside and women feel they can make noise during labour without being overheard. Soundproofing the room also means that women in the waiting room are not distracted or worried by the noise of women in labour.

Ancilliary spaces

Other rooms in the unit should include the supply room, a blanket warmer, clean linen supply and dirty linen hold, and a disposal room. The equipment store should be of a reasonable size. It needs to be located close to the birth room to reduce clutter and to allow flexibility in the use of different birthing support materials.

Biophilia: connecting to nature

An important element of health facility design is the connection with nature – to enable patients, family and the public to move easily out into gardens and courtyards. This is recognised as an important stress-reducing element. Considerable research by bioscientists in the past 30 years suggests that humans gain enormous psychological, physiological and certain health responses by engaging with living things.

Conclusion

The development of the patterns which led to the audit tool and the consequent review of built facilities will help provide documented evidence for use in the design of better birthing units. The literature supports the notion that physical environments provide both positive and negative effects on birthing outcomes. Women prefer quite specific types of places in which to give birth. If we can ensure the essential elements of these designs are provided in every case, we will have reduced anxiety, increased support and might expect to see reductions in the 'fear cascade' that creates the demand for interventions that could have negative consequences for both mothers and babies.

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Designing Healthy Communities: **The health impact of street vendor environments**

This study, spanning seven years, reveals how the informal architecture of the environments, in which street vendors ply their wares in countries like the Philippines, impacts on their health

Mary Anne Alabanza Akers, PhD, Timothy A Akers, PhD

The built environment plays a powerful role in the health of a population. Its influence has been documented in numerous studies, ranging from urban sprawl and its impact on obesity, diabetes and poor nutrition to highway development and the increase in pedestrian injury, and the impact of nature deprivation on low mental health and well-being. However, many of the existing studies have not used comprehensive research designs and methods; they lack multiple study points in time; and they have not interviewed respondents *in situ*.

This study contributes a perspective of design and health that goes beyond designing healthcare facilities for patients who are already diagnosed with health problems. It unveils a different world of people who work in busy, often chaotic, and noisy urban streets. Their environments are temporary, marginal, uncertain and fluid.

Such informal architecture is found in urban places all over the world[1]. In this context, it involves viewing the built environment within a framework that includes street people's cultural lifestyles, socio-economic values and spatial behaviour.

Baguio City street vendors

This study comprises a longitudinal and transdisciplinary study of street vendors in Baguio City in the Philippines. It is a fast-growing regional centre for higher education, medical services, business opportunities and tourism. Situated in the rugged upland region of the Cordillera Mountains, the city was planned for 50,000 people but now holds about 250,000 residents. Lack of official jobs and the economic downturn of many global cities have driven residents to legitimately earn a living on urban streets.

Typical female street vendors in Baguio City, out in the open, exposed to traffic pollution, weather and disease

Street vendors create spaces within existing buildings, sidewalks and streets to establish their 'territories' and sell their products. The result is a tapestry of informal architecture set on the existing built-environment infrastructure. The question is: "How does the architecture impact on street vendors' health?"

Literature on the health of street vendors has focused largely on studies related to public safety and food-borne diseases. Other research projects have examined vendor health in terms of pollutant contamination in their bodies and reproductive conditions [2,3,4]. These studies generally imply that vendors' presence in the streets for long periods of time poses an occupational health hazard.

However, to date, no study has delved into the physical environment – the architecture and land-form features – and its contribution to the health conditions of vendors. Furthermore, design guidelines to mitigate their health circumstances have not been addressed. This paper hopes to lessen this gap in the literature.

The study involved multiple research methods from 1999 to 2006. Table 1 (see p59) describes the various research phases of the project. The methods ranged from personal surveys and physical place assessments to health screening procedures. This eclectic use of research techniques has contributed to a comprehensive understanding of vendors and the impact of the street environments on their health.

Throughout the seven-year duration of the research project, two surveys were conducted – one in 1999 and the other in 2003 – with samples of 219 and 187 respondents, respectively. Many of these individuals were repeat respondents. Generally, the characteristics of the vendors are the following:

- At least 80% are women in their early 40s
- They have an average of four children.
- At least 50% have a high school education
- The majority of respondents have stayed in the same vending locations between seven

Street vendor concentration nodes scattered throughout the central business district

An important part of the environmental design plan is to 'pedestrianise' several streets in the CBD

and 11 years. Vendors choose to engage in this type of street occupation

- They work long hours – 10 hours a day, Monday to Sunday – and earn only about US$20 a week.

The research site

Baguio City's central business district is situated in a deep valley with four arterial streets leading to it. In the early 1900s the location was selected by the American colonialists as a resting and healing place for their troops. Documents written by military physicians have chronicled the positive impact of this upland city on soldiers' health because of its high elevation and cool air. From a quiet convalescent place, Baguio City transformed throughout the centuries into a busy economic engine for the region.

At the initial phase of this longitudinal study, the vendor spaces were measured, together with sidewalk widths and other physical attributes. The space metrics show that 44% of vendors are located in relatively flat areas and 56% are sited on steep inclines[5]. Topography is an important factor in the entrapment of air pollution, which in turn affects health conditions.

Another significant feature of the central business district is the high traffic volume that has exceeded its streets' carrying capacity. Major colleges and universities, government offices, as well as the city market, are magnets that draw people and diesel-run vehicles to its centre. Idling vehicles in the land basin and those running uphill on steep inclines contribute to the mix of polluted air and noise.

Also important to this study of place and health is Baguio's local climate. Elevated at 5,000 feet above sea level, the city experiences temperatures ranging from 10ºC during the cold months of December, January and February to around 30ºC during the warm months of March, April and May. Cold temperatures often create an inversion effect that traps polluted air during the early mornings. Warm weather, on the other hand, often brings an onset of gastro-intestinal diseases because of food-borne bacteria found in non-refrigerated foods that vendors either sell or pack from home.

It is also known for its prolonged monsoon season in which rainy weather is evident from June to early September. During this season, a rise in the incidence of flu and other respiratory problems is common.

Vendor sites & urban architecture

The local spaces that hold vendors' microbusinesses are varied, interesting and indicative of socio-economic factors. For example, the vendors who have established their territories for many years are located in spaces that are mostly flat and have high pedestrian traffic. Relative newcomers are left with secondary spaces in minor streets with moderate foot traffic. Vendors select their spaces based on the type of products sold, friendships and ethnic affiliation. Fruit vendors tend to settle in places adjacent to eateries while those selling hard goods like t-shirts, DVDs and household products are found close to banks and retail outlets. However, most, if not all, vendors use a part of the physical environment as a basis for their location decisions.

The urban architecture found in central Baguio City is characterised by diverse building types, uses and forms. Four- to five-storied modern designed buildings frame the main street. Other buildings are modest, with only three stories with ordinary architecture.

Building architecture impacts on the quality of vendor sites. For example, only 25% of vendors are located under building overhangs that span the entire sidewalk. In fact, about 32% of vendors are in sites that are not under any overhang. They are exposed to climactic elements like the monsoon rains and cold mountain air.

Integral to urban architecture is the presence of sidewalks fronting the buildings. As the owners have responsibility for constructing and maintaining sidewalks, the

infrastructure is included in the overall design of the property. This results in varying heights, widths and quality of sidewalks throughout the central business district. Sidewalk widths vary from seven to 16 feet[6]. Sidewalk density, as measured by pedestrian counts and sidewalk widths, has an effect on health conditions. Higher sidewalk densities create environments that encourage the spread of communicable diseases like influenza, bronchitis and pneumonia, especially during the monsoon season.

Street vendors soften and personalise the existing architecture by creating work spaces made of simple materials to display their products and work 'comfortably' for ten hours a day. Cartons and cardboard boxes make up fruit stands and tarps are used to display special items. Other vendors use building walls as stands for posters and magazines. The colourful array of products contributes to the finer textures of urban places.

Air quality

In 2004 the research team monitored and assessed the air quality in 30 populated vendor sites and a fixed site on the third floor of a building. Generally, the data showed elevated levels of pollution in many areas in the central business district. The data at the fixed site also indicated that particulate matter concentrations were higher than the National Ambient Air Quality Standards used in the United States.

Environmental factors such as building height, distance to a stoplight, street widths, number of street lanes and topography, as well as vehicular and pedestrian volume, were added to a group of other variables in a regression analysis model but were not found to be statistically significant. The factors that contributed significantly to street level pollution were traffic volume and wind direction[7].

The built environment and health

In his treatise *On Airs, Waters, and Places*, Hippocrates strongly links disease with place, particularly, a community's location and local climate[8]. This observation, though developed centuries ago, has come full circle as scientists today accept the connection between the physical environment and health. We have based this study of street vendors on Hippocrates' findings but the discussion has been extended to include the impact of the built environment and air quality on health. The variables considered in the analyses were:

Physical environment factors: slope; vehicular volume; vehicular movement (idling, moving uphill); pedestrian volume.

Architecture and built environment indicators: building height; building overhang; curb height; distance to a drainage hole; distance to a garbage disposal; and quality of the sidewalk.

Air quality: morning and afternoon monitoring of: particulate matter 2.5; particulate matter 10; and carbon monoxide.

Health variables: number of health problems experienced in 2003; type of health problems.

Results

Using bivariate correlation tests, the results showed the following patterns:

Slope and health conditions: A correlation between slope and type of health condition was found to be significant ($r=0.344$, $p<0.01$, $n=187$). Interestingly, vendors who experienced influenza and fever were located in steep slopes. However, when the data is examined more closely, these locations were also vendor sites with shorter sidewalk widths and higher sidewalk densities. The close proximity of vendors and pedestrians may contribute to the incidence of communicable diseases.

Vehicular movement: Vendors located in streets that have fast moving vehicles tend to have higher number of health episodes ($r=0.155$, $p<0.05$, $n=187$). However, it seems that another factor is involved in this situation. When correlation tests were conducted on measures of air quality and vehicular movement, we found that streets with fast moving vehicles in the early morning hours have the highest levels of pollutants (i.e. PM2.5, PM10, CO). The effect of nocturnal inversion is evident here. Considering that vendors arrive at their locations as early as 5.00am, they are exposed to high pollution levels at the start of their work day.

A thorough case study approach used to determine the relationship between vendor sites and health conditions was also conducted for the various sites. Of the 31 sites examined, two sites were the most problematic in terms of pollution levels and reported health problems.

The first site was Magsaysay Avenue, a highly congested artery leading traffic from the eastern portion of the city to the downtown area. It is also here where the public market and three adjacent universities are located. The vendors on that street reported incidence of colds, asthma, high blood pressure and arthritis.

Magsaysay Avenue has narrow sidewalks, compared to the other streets. The influx of students and people heading to the city market contribute to Magsaysay Avenue's pedestrian counts, which is the highest among all other streets in the central business district (40 persons per minute). As indicated earlier, communicable diseases such as influenza and colds are easily spread in dense environments.

Although the buildings' overhangs along Magsaysay Avenue cover about 100% of the sidewalks, protecting vendors from the monsoon rains, they also create a tunnel effect. With concrete walls and sidewalks this workplace can be very cold in the morning. This threatens vendors' immune systems, making them vulnerable to colds, coughs and even arthritis.

The results of the air quality monitoring phase of the research study also shows that Magsaysay Avenue site is one of the most polluted places in the CBD, especially during the afternoon rush hour. High traffic volume, idling vehicles that run on diesel fuel and disrupted circulation flow, as public vehicles drop off their passengers in undesignated spots, are responsible for the poor air quality in this street. Vendors suffer from asthma, intense headaches and high blood pressure.

Another site that gives evidence to the relationship between the built environment and health is Assumption Road, a secondary street that intersects the main street. The results of the 2003 health survey show that vendors here were sick three times more than the other vendors throughout the central business district. Among the health problems they experienced were colds, tightness in the chest, trouble breathing and intense headaches. The air quality is extremely poor during the morning rush hour. Vendors are located along a steep one-way street leading to several elementary schools and the heavy morning traffic consists of diesel fuel vehicles idling on an incline. Such a substandard environment may be causing

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Table 1 Research protocol for the street vendor study

Year	Research focus	Research methodology
1999	Social networks, microeconomic nature of street enterprises Built environment assessment	Survey of 219 vendors Physical inventory of vendor sites
2000	Relationships between street vendors and adjacent formal businesses	Visual documentation and informal interviews
2003	Health and environmental assessment	Survey of 187 vendors Physical inventory of vendor sites
2004	Air quality	Air quality monitoring on 30 vendor sites and one central fixed site
2006	Health screening and visual documentation	Medical screening for 15 vendors (e.g. physicals, blood tests, oximeter readings at vendor sites) In-depth health survey for 10 vendors Visual documentation of 30 vendor sites

some of vendors' health problems.

Compared to Magsaysay Avenue and Assumption Road, Harrison Road is considered the 'healthiest' site of all. Unlike other sites with similar traffic volumes, this street has the best air quality conditions. A major explanation for such good air quality is that the two sites on Harrison Street are adjacent to the main public park in Baguio City. Burnham Park is about an acre of green that stretches along Harrison Street. Its trees and good wind circulation mitigate the impact of vehicle exhaust on vendors' health conditions. Those located on this street did not report as many ailments as the others.

Design and planning implications

These results clearly demonstrate the relationship between health and the built environment. In the case of Baguio City, a drastic transportation plan to decrease the volume of traffic in the central business district will improve the health of not only street vendors but also the general population that live, work, recreate and go to school in the area.

A conventional solution would be to construct a bypass around the urban core – but that approach is far from being sustainable. To preserve the character of the city's centre, highways should not be built because these structures will only increase the dark and cold tunnel effect of urban spaces beneath them.

Rather, a framework that encourages satellite service centres around the city will decrease the number of vehicles entering the urban core.

Banks, professional offices, medical offices and other businesses can relocate to disperse services around the city.

An important part of the environmental design plan is to 'pedestrianise' several streets in the CBD. This move will decongest the sidewalks and encourage the use of urban spaces for more community-oriented (social, leisure, cultural, and arts) activities and active living, while increasing their economic vitality.

Several cities in India and Indonesia have closed major streets to accommodate pedestrians[9]. Evaluations of these planning strategies have yielded positive results. Businesses have increased their sales, air quality improves, users are more encouraged to stay in these places, crime decreases and urban spaces are enlivened.

Lastly, to improve the health of street vendors and urban residents living, working or visiting in the CBD, a greening movement should be embarked upon. Restoring existing parks to better health and planting vegetation around the CBD will improve air quality and decrease the effects of the urban heat during the hot, summer months.

Next steps

This longitudinal study of street vendors is an example of a transdisciplinary work. The extensive quantitative and qualitative data that was collected provided a description of places and people which helped us understand the relationship between the built environment, architecture and the health of, in this case, street vendors in the Philippines..

However, to validate the implications of the study results, a tangible intervention, such as implementing a transportation scheme to decrease traffic in the central business district, is necessary. Medical screening tests, pre- and post-intervention, can be extended to include the entire sample of vendors. These next steps would indeed put closure to the entire project.

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Perception and wellbeing:
The Impact of Colour and Light

Two New Zealand studies explore how the built environment can impact on mood – one, the internal features of a dentist's office, the other views from an office building

Dr Linda Jones & Dr Barbara Manighetti

People who are not normally bothered by anxiety may feel stress and anxiety in specific environments, where they experience both a sensory insult and a loss of power to change or control the conditions. Some environmental stressors, such as noise, extremes of temperature or malodour, are well documented[1,2,3]. But negative emotional responses can also be learned – in hospitals or dentists' rooms, for example.

Environmental psychology can also be applied to the workplace. Studies have established relationships between the physical environment and both work attitudes[4,5], and wellbeing[6,7]. Elements such as window size, sunlight or view, have been shown to affect levels of arousal and stress recovery[8,9] and even intention to quit[6]. The benefits of 'natural' elements are well documented[10,11].

Stigsdotter[12] explored stress and access to garden environments in Sweden, reporting greater workplace comfort where garden access was available, and asking whether a garden view could also have a causal influence on workplace wellbeing.

This paper reports on two New Zealand studies, each contributing to the growing body of knowledge on environmental perception and well-being, then discusses colour and/or light as explanatory mechanisms.

Study 1: 'Greens'

The study of a dentist's waiting room has been cited as a 'methods' paper, using environmental perception to illustrate how the choice of methodology can elicit different levels of understanding of a phenomena[13]. It was a partial replication of a study where Campbell[14] showed students a one-off 35mm-slide presentation of a professor's office and asked the students to rate their feelings about the environment and the professor. Campbell found that the presence of plants had a strong positive influence on students' feelings and the assumptions they made about the professor's character.

In Jones' study, a dentist's waiting room was presented using overhead projector slides – also to university students, but in groups. This made it possible to add a qualitative stage, where the groups discussed the experiment. The 102 students rated the 16 environments covering all combinations of the four independent variables – art, plants, seating arrangement and level of tidiness. The dependent variables rated how welcome and inviting it felt, and attributions about the dentist.

Ratings for the dentist's waiting room showed a near parallel pattern to the professor's office across all variables, except the dentist's waiting room was always more negatively rated than the professor's office.

Table 1 shows the relative ratings, by mean score only, of each of the environments. Tidy waiting rooms with plants had the four highest scores. The presence of plants provided more positive ratings for feeling welcome and feeling comfortable. Only in some combinations did art made a positive difference. Seating variations were not significant. While tidiness had very high scores, this was not significant either. The significance level was set at $p < 0.05$ (two-tailed) with 14 df in all cases.

In discussion, it was thought that the preferred seating would be one conducive to conversation between waiting patients. However, while most participants agreed that this would be the preferred arrangement in non-threatening environments, it was not the same for the dentist's waiting room – some preferred withdrawing from social contact when stressed and did not like seating where they felt they must interact. Others, however, said they would welcome social contact as both a distraction and support when stressed.

There were also competing discourses about tidiness. The cultural value placed on tidiness was explored and its implications for the quality of dentistry: if a dentist could not keep the waiting room tidy, could patients expect quality dental work? An untidy waiting room in a solo practice might suggest the dentist was busy and so was perceived positively. But in a large practice, the students felt untidiness indicated lower standards and less concern for patients' welfare.

Plants were spontaneously and specifically

Dentist's waiting room: while plants made people feel welcome, tidiness and art were not as significant

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IV art	IV plants	IV seating	IV tidiness	Mean of combined welcome/comfort rating	Mean rating of how busy dentist was
Art	Plants	Open	Messy	3.73	6.06
Art	Plants	Open	Tidy	4.88	4.35
Art	Plants	Closed	Messy	3.82	5.99
Art	Plants	Closed	Tidy	5.50	4.27
Art	No Plants	Open	Messy	4.26	5.81
Art	No Plants	Open	Tidy	4.78	4.09
Art	No Plants	Closed	Messy	4.10	5.85
Art	No Plants	Closed	Tidy	4.41	3.81
No Art	Plants	Open	Messy	4.28	5.92
No Art	Plants	Open	Tidy	5.97	4.31
No Art	Plants	Closed	Messy	3.34	6.33
No Art	Plants	Closed	Tidy	5.37	4.08
No Art	No Plants	Open	Messy	2.30	6.14
No Art	No Plants	Open	Tidy	4.07	3.88
No Art	No Plants	Closed	Messy	3.38	6.30
No Art	No Plants	Closed	Tidy	3.81	4.21

Table 1
Overall mean DV ratings (9 = high, 1= low). Highest rated environments are shaded

discussed, but more to suggest that 'greenery' is an important element in a wider variety of environments than the dentist's waiting room. However, gender differences may confound this finding. In a review of gender effects in environmental research, Zelezny, Chua and Aldrich[15] found that women held stronger attitudes to environmental issues than men. In the Jones study[13], the ratio of women to men was seven to three.

Study 2: 'Blues'

The relationship between the environment and physiological aspects of wellbeing is important for understanding the health implications of different types of employment[16,17]. Physical health may be adversely affected by stress[18], including 'daily hassles'[19] and more severe trauma[20]. Studies have linked wellbeing with windows[7], lighting and natural illumination[21], and natural views[11,22,23]. Mood (affect) has been suggested as the mediating factor linking environment and wellbeing, with pleasant environments either evoking a positive affect or lowering the negative affect and buffering the impact of stress. Restorative environments have been shown to lower blood-pressure[10,24] and cardiac inter-beat interval[25].

The aim of this study was to examine the influence of view on employee mood and self-rated health at a single workplace, based on the work of Ulrich[8,9,23] and Hartig *et al.*[10]. The hypothesis was based on the probable link between office view and wellbeing, with mood as a likely mediating factor. A good view was predicted to be associated with higher positive affect and/or lower negative affect scores – and with better perceived health. Confounds from age, organisational seniority and sex were anticipated.

Method

Eighty anonymous participants were recruited through a questionnaire delivered to staff mailboxes at the National Institute of Water and Atmospheric Research (NIWA), in Wellington, New Zealand. There were no inducements. The NIWA building is oriented roughly north-south. Offices either faced east, with a natural view, or west, facing an urban development. The 200+ employees were mainly scientists, and formed a relatively homogeneous population in work tasks, socio-economic status and intelligence.

The questionnaire instructed participants to consider their responses "while at work". It included the Positive and Negative Affect Schedule (PANAS)[26] for mood states, and three visual analogue scales (VAS). The first rated job satisfaction, the second was for perceived health, and the third assessed how the participant rated the health of an average person of a similar age. Demographic questions covered the employment variables at the NIWA.

Finally, participants were asked to rate their east- or west-facing office view on a four-point scale (poor to excellent), and to indicate time spent in their office on an average working day. In addition, they were asked for the date and time they completed the survey, in order to control for possible confounding or moderating effects such as weather or day of the week.

Results

The data was grouped separately for the occupants of offices with a natural view (east) and those with the urban view (west). Self-rated health results were adjusted so that reported scores reflected the extent to which the participants believed their health was better or worse than expected for their age. Data were analysed using SPSS.

There was no difference in positive affect scores no matter what the view but there was a small difference in negative affect, showing that people with the urban view were 'grumpier' on average than those with a natural view.

For self-rated health, the natural view was significantly correlated with better health than the urban view ($t = 2.47$, df (78), $p = 0.02$), even though those with the urban view rated their health as above average for their age. There was a significant, low to moderate positive correlation between self-rated health and negative affect ($R = 0.3308$, $p < 0.01$). Job satisfaction showed a minimal and non-significant correlation with health and no correlation to either category of view.

To explore further influences on perceived health, analysis of covariance (ANCOVA) calculations were used to determine whether the relationship between view and health was mediated by negative affect or some other factor. After testing for between-subjects effects of positive affect, negative affect and job satisfaction, the view-health relationship was found to maintain significance ($p = 0.038$). This indicated an independently significant correlation between view type and perceived health, with negative affect acting as a moderator in the relationship.

Those who had a sea view showed a higher rating for their perception of their own health

Discussion

The results supported the hypothesis that there would be a small difference in perceived health between participants with a natural view from their office windows and those with an urban view. A notable departure from previous studies, such as that by Ulrich[23], was that despite a correlation between negative affect and view type, the relationship between view and health persisted even when mood was controlled for. Positive affect was not shown to vary with either view type or health status. Furthermore, the study conditions were a conservative test of the effect of view, given that the urban view was not especially unpleasant and that the employees had access to sea views at other times.

It is possible that the observed relationship might not be due to the sea view at all, but an effect linked to the subliminal effects of colour or colour combinations, such as blue on blue (sea and sky), or blue and green (sea/sky and peninsula), or the amount of sea or sky or green peninsula that was visible. Neither can it be excluded that, with marine scientist respondents, a sea view maximised the 'congruence' between environmental perception and activities or aspirations. A similar hypothesis by Stone[27] has been tested and supported. It is interesting to speculate on what the findings would have been had the respondents been architects or psychologists. If people intrinsically prefer a sea view, then assertive workers may work to gain this advantage[28,29,30].

This led us to wonder about a number

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Participants with the urban view were 'grumpier' on average than those with the sea view

of possible confounding and/or moderating variables. For example, how does the geographical or cultural context of a view impact on wellbeing? Would people from landlocked nations and maritime nations have the same correlation between mood and sea view?

While the NIWA offices had similar hours of sunlight, new research in circadian rhythms suggests the time of day maximum sunlight is experienced is important. Synchronicity between personal circadian and external diurnal rhythms promoted by exposure to early morning sunlight may be the reason those with east-facing offices had better perceived health. This could be explored in a future study by measuring perceived fatigue versus office orientation or brightness and timing natural illumination.

When Mayo and colleagues[31] discovered that manipulating factory lighting led to improvements in production, their groundbreaking message was that doing anything for employees may improve productivity because people respond to attention. However, 70 years on, what might have been lost with the establishment of the 'Hawthorne effect'[32] is that lighting does have psychophysical effects. Workers may have been responding to attention AND light after all.

Conclusion

Study 1 concluded that greenery made such a positive impact that not only might dental patients feel more comfortable in a plant-containing waiting room, but we suggest that the dentist-patient interaction might be improved by this simple modification. Importantly, exploring the environmental context of anxiety shifted from individual coping to acknowledging the wider influences on behavioural reactions and hence the importance of design on wellbeing.

Study 2 concluded that there was a positive relationship between natural views and office occupants' wellbeing. Colours in the view, especially blues and greens, and light are suggested as the critical variables.

Together the findings raise questions about possible unconscious needs for certain colours, particularly blue and green. Lewis[33], Kozak[34], and Norfolk[35] go further to suggest that evolution ties us inextricably to nature and fundamental narratives in Western culture may reinforce the connections, making access to nature a prerequisite to wellness. The urban descriptor 'concrete jungle' is associated with misery. It encompasses both what there is (concrete) and what is missing (jungle). We trust that collaboration between social science and innovative design may lead to solutions.

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Arts and Culture

Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life

Kellert S R, Heerwagen J H, Mador M L
Wiley Blackwell, 2008 Price: £39.99 / €50

This well conceived and edited book is published at a time that requires a fundamental generational rethink about the impact of buildings, both in terms of their environmental performance and their impact on human health and wellbeing.

Paradigms are shifting, with a greater focus on the value of health and environmental capital as opposed to financial wealth, calling into question current design and investment decisions, at both a micro and macro level.

Long-term or short-term investment: you decide, or the markets will decide for you. Without the easy intrinsic 'off-plan' growth of the last decade, clients and developers will be looking for a new language of value and performance, and different forms of cost accounting that properly appraise the morphological and bio-diverse benefits of buildings that plan to reduce the running costs, maintenance and rehabilitation of our existing buildings.

Biophilic design is not a mainstream phrase associated with the response and intuitive affiliation of human systems with nature. And some architects of certain generations (including this reviewer) raised on Erskine, Aalto, Asmussen, Cullinan, Christopher Alexander and other iconic European theorists and urban practitioners, all referenced here, might find themselves scratching their geodesic domes.

They would recognise the case being made for fundamental design qualities where nature is included in the built environment, not the separateness of evidence and theory meshed together by technology – raising their eyes out of a 'room with a view' to rest on where the argument had been buried in the garden.

This is the essence of the book. It is making the case for consideration, with extensive case studies, research papers with illustrations and an exposition that takes the subject way beyond abstract consideration. It is saying whatever environment you are planning, think of these principles and sensibilities and if you need justification for a more responsive design here it is.

So leave this book on your client's and your funder's desk, or lift key sections out of the chapters to green your business case. None of these chapter authors will mind. And if you have been feeling left out and old-fashioned in the past few years with the triumphant pall of procurement over planning, dust down your old post-occupancy evaluations that asked the cancer patient what was important – the immediate outside space, the bird at the table, the door for children to play outside when visiting. When we are ill, we need the immediacy of a supporting safe environment.

Tensions with technology – yes, let the argument commence, if they can hear you in Third Life behind the headphones. Get this publication a Facebook site now and plan the coolest party in town. Chapters address our neurological response to the stressors and inhibitors that are placed on our environments.

It begins to inform how we become part of a building's life cycle experience, reconnecting us to a new living architecture that can respond to intense change but without degrading core infrastructural elements. It is about how we might manage the end of things that previously made our cities work and are familiar to our parents and to us.

The application of the lower technologies into some of the most sophisticated buildings of our time are illustrated: the Swiss Re Tower, SkyCeilings in surgology, green roofs over familiar city banks, new places reflecting aspects of scale, protective and variable. And there are places and spaces that we might look to beyond this now.

We should explore how the Finnish utilise mobile phone technologies for better access to healthcare professionals from the home. Every township has a mobile phone mast, so let us make the case for health networks free at the point of access.

Mental health therapies harnessed in a series of gardens in Stockholm, hurricane resilience planning and urban agriculture in Havana. As these levels of intervention illustrate, there is much good new practice out there by inspirational individuals. And so much design complacency to attack, as this fine publication encourages.

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Le Corbusier – The Art of Architecture
The Crypt, Liverpool Metropolitan Cathedral, until 18 Jan 2009
www.architecture.com/le Corbusier

Restoration of the Living Ideal

So many sins have been committed in the name of Le Corbusier, it is hard to separate the man from his reputation. Veronica Simpson visits a major exhibition exploring the enduring legacy of the iconic architect, writer and artist

While the carcasses of countless sink estates – often shoddily assembled imitations of this mass-housing blueprint – still haunt our urban landscapes, the negative impact of this image, only one of Le Corbusier's big ideas, can obscure us to the brilliance of the others.

But what this exhibition – his first major retrospective since the late 1980s – sets out to do is restore our understanding of the man as an artist, an idealist and a thinker; a 'man of letters' as he chose to describe himself in his passport. After all, he authored nearly as many books as he did buildings.

Beneath the vaulted brick ceiling of the crypt in Liverpool's Metropolitan Cathedral, a rich assortment of plans, paintings, home movies, sculptures, drawings, furniture and even scribbled tear sheets from some of his legendary lectures are assembled to help us see how his inspirations, ideals and buildings evolved over his lifetime.

There are beautifully preserved models of his most famous projects – the villas, the churches and even a wooden model of his visionary capital city at Chandigarh – as well as virtual, digital recreations of pavilions and buildings he designed but never got to build.

Evolution of spirit

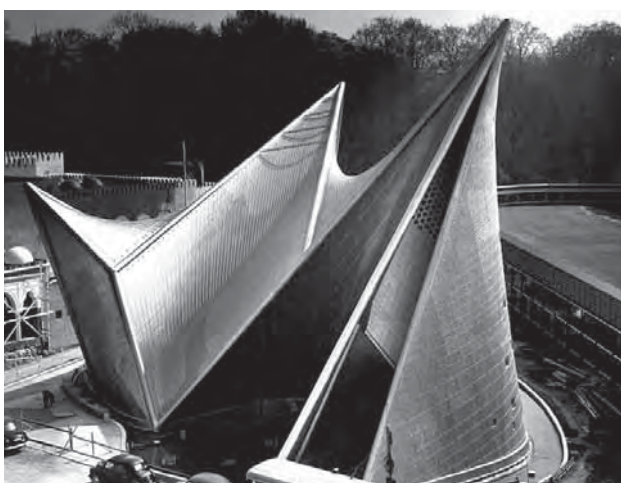
We see how this ambitious and energetic man moved from the youthful zeal of his days as a 'purist', eschewing the frills, folksiness and flourishes of previous architectural eras for clean lines, open space and bold, white exteriors shaped by the logic of the building's interior plan; how his travels through Africa and Latin America inspired a more sensual and organic response; and how, despite his declared agnosticism, he was able to create some of the 20th century's most striking and beautiful spaces for religion and spiritual worship.

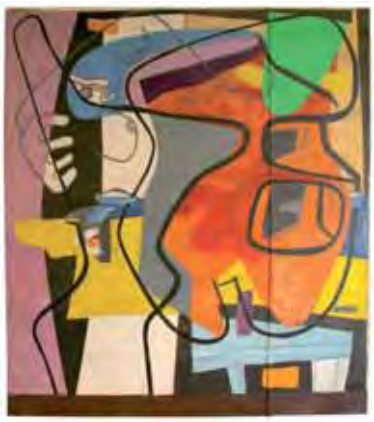
Though it was architecture that made his name, he was a prolific painter, very much in the style of Picasso. He allegedly spent every morning at his easel, saving the business of architecture for the afternoon. And when he wasn't painting, travelling or creating buildings, he immersed himself in the ideas of the day, producing and disseminating his particular brand of design evangelism through many books and magazines. "My own duty and my aim," he wrote in his youth, "is to try and raise people out of their misery...to provide them with happiness, with a contented existence, with harmony. My own goal is to establish or re-establish harmony between people and their environment."

Above: Portrait of Le Corbusier

Below left: The Pavillon Philips

Below right: Notre Dame du Haut





Left: A Le Corbusier mural

Right: Chaise Longue Thonat-Freres

Below: Pavillon Suisse

To look at his buildings – like the Villa Savoye, the domestic 'machine' at its most elegant – is to see these ideas writ large. But, like all geniuses, he was flawed, his inspired rhetoric and idealism sometimes carrying him far beyond what might seem desirable to most mortals. The thought of having to live in the 2km-long wall of high-rise dwellings he designed to run the length of the bay of Algiers, is truly horrific.

And even our exhibition guide declared the citizens of Paris 'lucky' not to have had his vision for a new Parisian metropolis – 1925's Le Plan Voisin – inflicted on them, the city's rococo excesses stripped away in favour of a uniform vista of tower blocks and barracks-style multi-storey dwellings.

…his inspired rhetoric and idealism sometimes carrying him far beyond what might seem desirable to most mortals

Reforming zeal

But it's worth being reminded that Le Corbusier's first completed mass housing project, L'Unité d'habitation, was conceived as a utopian city in the sky. The apartments were all intended to be luxurious dwellings, with fitted kitchens, double-height lounges and private garden terraces, the community served and strengthened by generous integral gathering spaces and facilities – a roof terrace adorned with playgrounds, creche, gymnasium; and an internal street stuffed with shops and eateries.

I left the exhibition convinced that the power of his buildings lay in that heady combination of technical virtuosity, reforming zeal, and the evident poetry in his soul, nurtured and maintained through his dedication to art, travel, sculpture, and the life of the mind.

In lesser hands, his ideas were quickly corrupted, seized on by individuals more seduced by the economy and speed with which massive housing units could be constructed. The failure of these buildings as dwellings, when cheaply built, badly sited and filled with the urban poor, cannot be laid at his door.

As The RIBA Trust photographic footnote at the end of the exhibition reminds us, in the right hands, his ideas could inspire brilliant buildings – London's Barbican and the Southbank complex to name but two. It's a timely reminder, however, as new cities that celebrate the egos of the world's leading architects are constructed all over the Eastern part of the globe, that architecture is only one element in the mix.

Intelligent social engineering and a robust, supportive infrastructure are what creates truly healthy environments and cities.

Veronica Simpson is an architectural journalist

The Le Corbusier exhibition has been produced by the Vitra Design Museum, in co-operation with the RIBA Trust and the Netherlands Architecture Institute

Invest to save

Gunnar Öhlén says a whole life costing approach to capital investment in the global healthcare estate will reap long-term rewards

The world is full of appropriately planned and well-intended healthcare buildings. But, all too often, as a result of financial compromises agreed towards the end of the planning process, the final outcome results in a suboptimal building that fails both patients and the healthcare staff that work there. As head of a large emergency department, less than 10% of my annual budget and that of the hospital relates directly to the built environment. Yet, every day, it's possible to observe how the qualities of our healthcare buildings negatively impact on the wellbeing of our patients and staff.

In recent years, one of the greatest influences on any decisions I have been involved with in relation to new projects and refurbishments, has been an article by Berry *et al*[1]. Berry discusses the impact and need for additional investments to be made in the hospital environment. In particular, he calls for larger private patients rooms, acuity-adaptable rooms, larger windows and larger patient bathrooms with double-door access, hand-hygiene facilities, decentralised nursing substations, additional HEPA filters, family/social spaces on each patient floor, a health information resource centre, mediation rooms, a staff gym, art for public spaces and patient rooms, and healing gardens.

He explains not only the clinical value of these key features, but also the economic benefits they can bring to the hospital's bottom line, by reducing patient transfers, falls, nosocomial infections and the costs associated with drug delivery.

Creating a better working environment also has an influence on staff sick leave and turnover. Research at the Karolinska University Hospital by Hagerman *et al* shows that noise-reduction measures have influenced the physiological parameters of cardiac ICU patients as well as staff[2].

All too often, however, financial restraints create suboptimal healthcare buildings, resulting in an increased operating cost, which ultimately represents 90% of the overall department and hospital budget. Berry *et al* suggest another road. By increasing the initial building investment by 5% above the baseline to improve the quality of care for patients and the working environment for staff, operational building costs can be reduced dramatically, providing a payback time on extra initial investment of only 6-10 months.

In short, there exists a clear choice for those financing our healthcare buildings. Invest at the outset of a project to decrease the annual running cost of the facility by 5% and, depending on the value of the initial investment, after a number of years you will have saved the cost of the entire building. Fail to make that investment and, after the same period, you will have spent the whole building cost again. This is the evidence base upon which capital investment decisions in healthcare buildings should be made, but are we doing enough to make this knowledge available and accessible to the bodies that finance our healthcare buildings?

To play devil's advocate, it might be argued that the capital investment simply isn't available to build that optimal ten-storey building needed. My answer would be to build nine optimal stories that in turn will generate the capital for another new optimal building. The alternative is being saddled for 40 years with a suboptimal, potentially dangerous 'white elephant' building for our patients.

Let's climb the barricades. Let's raise our voices. Together we can refuse to build healthcare facilities that are not based on a credible platform of evidence. As Winston Churchill said: "We shape our buildings and, afterwards, our buildings shape us."

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