

FIRST SUCH ARCHITECTURE

SOCSO rehabilitation centre

Far from the usual

INSIDE

FROM THE DESIGN & HEALTH
WORLD CONGRESS IN HONG KONG

Design and Health Scientific Reviews
Report of Several Case Study Projects



Design with Human Scale

Architecture is for the people.

Human scale is the fundamental element of our design. We turn concepts into sustainable reality that is aesthetically pleasing, planned for flexibility and detailed with practicality, optimizing well-being.



www.p-t-group.com

33/F, 633 King's Road, North Point, Hong Kong Tel : 852-2575 6575 Fax : 852-2891 3834 E-Mail : ptaehk@p-t-group.com

Hong Kong • Singapore • Bangkok • Shanghai • Beijing • Wuhan • Dalian • Chongqing • Shenzhen • Macau • Hanoi • Ho Chi Minh • Jakarta • Kuala Lumpur • Dubai • Abu Dhabi • Doha





St Stephen's Hospital, Hervey Bay



Zhejiang Hospital, China

CONRAD
GARGETT

Designing healing
environments

conradgargett.com.au



WORLD HEALTH DESIGN

6 International Academy For Design & Health

Trends and influences on design and health around the world – including Australia, the Middle East, China, India, South East Asia, Africa, Europe and North America – were all covered on the 11th Design & Health World Congress & Exhibition in Hong Kong.

By Alan Dilani



WORLD HEALTH DESIGN

PUBLISHED BY
The International Academy for Design and Health
P.O. Box 7196, 103 88 Stockholm, Sweden
Tel. +46 70 453 90 70
academy@designandhealth.com
www.designandhealth.com

BOARD OF EDITORIAL DIRECTORS

Prof. Alan Dilani
International Academy for Design and Health, Sweden
dilani@designandhealth.com
Prof. James Barlow
Imperial College London, UK
Nicola Bertrand
John Staff Management Consulting, Australia
Prof. Mike Kagioglou
University of Huddersfield, UK
Prof. Andrew Price
Loughborough University, UK
Ken Schwarz
AECOM, USA
Prof. Patricia Tzortzopoulos
University of Huddersfield, UK
Mungo Smith
Medical Architecture, Australia

GRAPHIC DESIGN

Helena Öhrman
Studio Indigo

PRESIDENT

James Barlow, Ph.D.

FOUNDER

Alan Dilani, Ph.D.
Tel. +46 70 453 90 70
dilani@designandhealth.com

EDITORIAL ADVISORY BOARD

has been selected in the
11th World Congress in Hong Kong

SUBSCRIPTIONS

whd@designandhealth.com

Volume 9 Number 1

ISSN 1654-9694

To receive regular copies of WORLD HEALTH DESIGN
send an email to: whd@designandhealth.com

YEARLY SUBSCRIPTION RATES

1 year: £80; 2 years: £150; Single Issue: £30

No part of WHD may be reproduced or stored in
a retrieval or transmitted in any form, electronic, mechanical
or photocopying without prior written permission of the
Board of Editorial Director

Design & Health Scientific Review

10 Health service and infrastructure transitions

A comparative study of UK, US and Canadian hospitals. Significant organisational change in healthcare is increasingly common as health systems

By James Barlow et al.

26 Buildings, Brains and Behaviour

The recent alignment of architecture, neuroscience and psychology has recast our understanding of how building design influences people's states of mind. Testable scientific hypotheses open up new avenues for the synthesis of these disparate fields of inquiry.

By David Techau et al.

40 Landscape Therapeutics

Too often, hospital exteriors appear fortress-like, uninviting. This occurs both by design and by default.. A paradigmatic shift is underway in the hospital campus planning and landscape architecture discourse.

Shan Jiang and Stephen Verderber

52 The Salutogenic Hospital

Inclusive Design for promotion of health and wellness in India. A patient's hospital stay period and experiences as part of the holistic recovery process could be improved by promoting Salutogenic Philosophy.

By Dr. Ragini, N. Mohanty et al.



Case Study Projects

64

Healthy Ageing in China

The need for healthy ageing is a challenge to many countries with a significant share of elder people. The literature refers to the China's ageing population as a ticking time bomb, a challenge and also an opportunity,

By Almas Heshmati



74

A Breath of Fresh Air

Socso Rehabilitation Centre in Malacca is the biggest and first such centre in Malaysia, and probably South-East Asia, that combines medical and vocational rehabilitation with an allied health institute.

By Wong Li Za

98

Healthcare services in a Women's Health Center

Chinese culture is based on many ideas of mind/body awareness and the rebalancing of life forces. A traditional idea is that a carefully designed setting can assist this process and help the patient and their family to think about natural forces

By Richard Sprow and Xiaodan Luo

80

Innovation in The Healthcare Industry

Healthcare challenges calls for innovation: to manage healthcare with greater efficiency, ensuring better healthcare quality for a greater number of patients, and for reduced costs.

By Angela Lee et al.

110

Hospital Südspidol Luxembourg

The concept for the design of the new hospital Südspidol n Luxembourg adopts a campus typology and combines the rational organisation of functions with a human scale to improve way-finding and optimise efficiency.

By Albert Wimmer



Panel discussion lead by Nicola Bertrand (Australia) and from left Ian Mitchell and Katharina Nieberler-Walker (Australia), Saiful Aziz and Edmund Cheong (Malaysia) Prof. James Barlow President of Academy (UK) and Joel Chan (Hong Kong).

Leading experts from Academia and Industry discussed with ministers the challenges of Health Promotion by design

The International Academy for Design and Health is a unique international forum for the exchange of ideas about innovation of the future system of healthcare design and services around the world.

The IADH's 11th Design & Health World Congress & Exhibition in Hong Kong saw presentations by leading international, local and global organizations from both the medical and architecture professions on the impact of the built environment on our health, wellbeing and quality of life.



Hong Kong, China 15-19 July 2015

Design & Health
11th WORLD CONGRESS & EXHIBITION



The congress opened with a speech by Hong Kong's minister of Health Dr. Ko Wing-man, followed by keynote speeches by global experts from both academia and industry on the latest research findings and their application. During 3 days of plenary sessions, the congress covered a wide range of topics. Global visionaries in the fields of design and health and urbanism, including Dr. Ken Yeang, the father of ecological architecture and author of *Ecological Architecture and Green Design*, and Prof. Joseph Sung, President/Vice Chancellor of the Chinese University of Hong Kong discussed global health challenges.

The congress addressed the challenges of design for elderly care in Asia, the design for children and future generations, and the latest research findings



Dr. Ko Wing-man Health Minister and Prof. Alan Dilani, Founder of Academy.



Dr. Ken Yeang, the father of ecological architecture.



Prof. Joseph Sung, President/Vice Chancellor of the Chinese University of Hong Kong

on topics such as health promotion, sustainable design, research-based design, healthy communities, mental health, senior care and government health policy. Trends and influences on design and health around the world – including Australia, the Middle East, China, India, South East Asia, Africa, Europe and North America – were all covered. Drawing on a full range disciplines, and outlining examples of use of the built environment in providing high quality healthcare, enable a broader dialogue between architects, designers, health planners, engineers, public-health specialists, physicians, health administrators and others to be created.

The congress ended with a panel discussion which included former Secretary of Health Dr. E K Yeoh, Deputy Minister of Health for Vietnam, Prof. Pham Le Tuan, as well as Deputy Minister of Health for Hong Kong, Prof. Sophia Chan.



Prof. E K Yeoh, Former Hong Kong Secretary for Health, Welfare and Food, Director, JC School of Public Health and Primary Care, Faculty of Medicine, The Chinese University of Hong Kong. Faculty of Medicine, The Chinese University of Hong Kong.



Ministerial Panel Discussion – from left: Prof. E.K. Yeoh Former Hong Kong Secretary for Health, Welfare and Food, Prof. James Barlow, President of Academy (UK), Prof. Sophia Chan, Deputy secretary for Health, (Hong Kong), Dr. Massoud Skaker. Head of Infrastructure, (South Africa). Prof. Stephen Verderber, University of Toronto, Prof. Pham le Tuan, Deputy Minister of Health (Vietnam), Prof. Roderik Lawrence, University of Geneva (Switzerland) and Prof. Anthony Capon, United Nation University in Kuala Lumpur.



Saiful Aziz winner of Academy Award, Salutogenic Design Project from Lead judge Stéphen Vermeulen.

Introducing the next World Congress on Design & Health in Johannesburg in July 2016, the Minister of Health for South Africa explored the need of healthy infrastructure in African countries and health affordability.

On the final evening of the congress, the annual Design & Health International Academy Awards were presented at a gala dinner. Awards were judged by leading international researchers and practitioners, recognizing excellence and helping to benchmark design quality.



Mr. Edwin Wong, the winner of Design and Health Lifetime Leadership Award 2015 from Prof. Alan Dilani and Prof. Ian Forbes former winner of Lifetime leadership Award from Australia.



From left: Natalie Walsh, the Judge gives one of the prize winner to Ian Mitchell, Stefano Scalzo and Katharina N. Walker for the successful design of Lady Cilento Children's Hospital, Brisbane, that was the winner of five categories award winner in 2015.

Prof. Alan Dilani, founder of the IADH, commented:

"The key message of the Congress was to promote the role of design to support of creating a healthy society. The 20th Century dominance of the medical and pharmaceutical industry has led to commercialization of sickness that we can no longer afford. We must now look for ways to commercialize better health and explore how the designed environment can facilitate healthier lifestyle choices. Global health systems are seeking ways to challenge the 21st century challenges of chronic disease, ageing populations and rising health-care costs. The Congress explored a new paradigm that focuses on the impact by the physical environment and our lifestyle choices in the prevention of disease and the promotion of health. Therefore we need new ways to design salutogenic hospital that operate more on prevention and on health promotion".

Future direction of Academy new website:

www.designandhealth.com

At the congress, the Academy had a very fruitful discussion with the advisory board and board meeting about its future in light of Alan Dilani's decision to step down from 2017. The new direction of Academy is reflected in the design of new website that clearly shows the main core of activities.

The Academy's target audience remains the following;

- **INDUSTRY**, for networking with clients and access to the Academy for the support of their ideas and products.
- **ACADEMICS**, as a forum for completed or continuing research and stimulus for potential new research and publication.
- **POLICY MAKERS, GOVERNMENT**, to provide a better understanding of key issues of healthy build environment.

The core activities of Academy remain the following;

- **THE WORLD CONGRESS ON DESIGN AND HEALTH** as a leading forum to discuss healthcare design and knowledge of healthy built environments.
- **THE INTERNATIONAL ACADEMY AWARDS** to present and create benchmark that recognize the successful works of industry and creating references of the best practice of healthcare design and healthy built environment.
- **THE JOURNAL WORLD HEALTH DESIGN** as unique publication to link the research and practice with publication of case study project as well as research. finding to discuss the challenges of healthy built environment.

ACADEMY SEEKING NEW LEADER

The International Academy for Design and Health provides the most dynamic platform for know-ledge communication and networking with the academia, industry and governments in this field.

The Academy is seeking a new leader to take responsibility and help address the challenges of the new era, and continue the work of the Academy in providing a leading forum to discuss critical issues of healthy built environment.

The new leader should have interdisciplinary background and clearly understand the value and impact of salutogenic design in the promotion of healthy society in the 21st century. Therefore the Board of Academy is searching for an enthusiastic professional with proven track and well documented experiences in the field of Design and Health in order to lead the Academy forward.

Contact Prof. Alan Dilani at the Academy, please send your application with CV to; info@designandhealth.com

Design & Health
International Academy for Design and Health

Managing major health service and infrastructure transitions

A comparative study of UK, US and Canadian hospitals

James Barlow, Jane Hendy, Danielle Tucker

Introduction

Significant organisational change in healthcare is increasingly common as health systems evolve in response to innovations and process improvements, and to the changing demands for healthcare. Sometimes new health service designs need to be supported by changes to the healthcare infrastructure if they are to be successfully implemented and sustained – service delivery models and its built and technical infrastructure must be transformed simultaneously. Just tackling one of these issues is challenging for all involved. Doing both these tasks at the same time can be overwhelming and risky.

But there can also be advantages in such radical change. It can provide an opportunity to radically rethink ways of delivering healthcare. Conducting simultaneous infrastructure renewal and service redesign means that care processes, not plausible in the old infrastructure, may be more easily designed into the new facility.

Major restructuring efforts are rarely systematically evaluated with outcomes measured or best practice shared (Walston and Chadwick, 2003). However, we do know that ‘whole system’ organisational change in healthcare – change which impacts on all areas of the organisation across all levels and stakeholder groups – is often hampered by a failure to plan effectively (NHS, 2008). It is generally accepted that the successful introduction of healthcare innovations requires the approval of relevant stakeholders (e.g. physicians, government bodies, primary care providers), and that planning and implementing major changes in healthcare service or infrastructure design requires practice-based examples to learn from.

While there is considerable experience in the planning and implementation of health services changes, there is little written about combined services and infrastructure change. Organisations searching for such information may have to look for examples

beyond those found in their own country. Studying similar cases across different organisational and international contexts also increases the likelihood of determining pivotal factors that underpin success.

Research approach

The aim of this project was to investigate the transition planning, stakeholder engagement and management processes underpinning a move from an existing hospital to another new facility. This inevitably involved significant redesign of healthcare processes and services, along with their supporting infrastructure.

We adopted a comparative case study approach as this offers increased external validity, creating more generalisable forms of knowledge (Yin, 2009). We were assisted in our search for suitable case studies by the US-based Center for Health Design (www.healthdesign.org), an evidence based research group assessing design decisions and innovation in new healthcare facilities through its ‘Pebble Project’ programme (Joseph and Hamilton, 2008).

The three selected cases all involved replacing an older hospital with multi-bed wards. Each new hospital has an all-single room configuration, and is approximately the same size (300-500 beds). Each approached the project to redesign organisational and work process in its own way. The challenges for each were significant, involving a shift from a ward to single room configuration and the incorporation of significant internal process changes (see box 1)

The period over which each of the three projects unfolded was similar. In each case the old hospital building was either demolished or converted to non-clinical uses such as conference or teaching space, marking a clear distinction between the previous hospital and the new building. In two of the three cases there was physical move to a site some distance away from the old hospital.

Box 1. Single occupancy rooms

- Single occupancy rooms present a number of challenges to healthcare workers in hospitals, including different relationships with co-workers and patients, changed perceptions of patient visibility, increased by-the-bed patient care interactions, altered resource allocation and the need for different communication techniques (Mooney, 2008; Young and Yarandipour, 2007; Ulrich et al., 2008; Maben et al. 2015a, 2015b).
- Single rooms accounted for around 28% of beds across the UK's National Health Service (NHS) at the time of the research. In the US and Canada there is longer experience of single occupancy rooms, but the transition from a ward model to this models is still relatively under-researched.
- Evidence for the benefits of single-room accommodation, derives mainly from empirical work in the USA and Scandinavia, includes reduced infection rates, fewer medical errors, faster patient recovery rates, increased patient comfort, privacy and safety, and increased patient satisfaction (see Maben et al. 2015a, 2015b). Other studies of patients show increased feelings of isolation, especially in the elder population as a result of single rooms (Mooney, 2008). Despite this conflicting evidence hospitals in health systems around the world are beginning to develop a single room approach to hospital healthcare delivery, at least for a large proportion of hospital beds.

Our data comprises 155 interviews, complemented by analysis of 205 documents, including internal reports and minutes, publicly available reports and research, and media coverage. We also made field notes from 36 hours of observations, including several tours of the old and new hospitals (both when under construction and completed), informal research observations and impressions, and attendance at staff visits to 'mock-up' of the new designs (see Appendix).

Different approaches to change

Although there were similarities across all the three cases, each adopted a different approach to the way it managed the transition from one site to another. Some factors which influenced the organisation's approach to change management are described in box 2.

When organisational change occurs, organisations make reference to past events and the collective attitudes, behaviours and actions of various stakeholders influence the change management process. Organisations have their own history and context which plays a role in their management and decision-making style. Our three case studies were no exception. Their

Box 2. Influences on organisational approaches to change management

A number of factors were found to impact on the organisations' decisions in designing their approach:

- *Experience of organisational change* – where an organisation has extensive experience of organisational change they are more likely to focus on this experience either as a means to improve on previous change management or to bring in new strategies.
- *Funding of the project* – this impacts on the level of investment, often with stipulations on how and what funding should be allocated.
- *Access to facility* – often dictated by financial arrangements but also the logistics of the transition particularly move day and facility opening. Pivotal are both the amount of time the organisation has access to the facility prior to opening and to what extent the building is viewable and fit for purpose during this access.
- *Organisational culture* – how the organisations structures, goals and policies dictate their transition options and how receptive organisational members are to change.
- *External view of the project* – public, political or other stakeholders' attitudes to the new building are a determining factor. The source of funding for the facility also plays a role in expectations of expenditure.

history, memory and context helped influenced their approaches to transition planning and implementation. Residual effects of organisational context can impact change management in the following ways:

- Using past experience of change management can help build confidence and trust between the employees and management teams within the organisation (Lines et al., 2005).
- Negative memories of previous organisational experiences can act as a springboard – both positive and negative – for creating a new set of principles (Anteby and Molnar, 2012).
- Attitudes to risk-taking often correlate with the organisation's history of success with previous risky decisions or behaviours (March and Shapira, 1987).
- Residual effects of previous experience may impact on the way an organisation attempts to be seen (e.g. through the media) and its attempts at external engagement (Weick and Quinn, 1999).
- The momentum of the transition project can be harnessed or restrained by individuals within the organisation and their understanding of the change (Poels et al., 2011).

These factors led each of our case studies to take a different approach to the various aspects of change management, summarised in Table 1.

Pembury Hospital (now renamed as Tunbridge Wells Hospital), Maidstone & Tunbridge Wells NHS Trust, England.

This project involved the demolition of Pembury (91 beds) and Kent & Sussex (281 beds) Hospitals and reconfiguration of services around a new hospital on a greenfield site (see Maben et al., 2015a). All acute services for the western part of the county of Kent were to be consolidated at this site. The new facility (512 beds) opened over two phases in January and September 2011. The transition involved moving

from a mixture of 4/6 bed bays and some larger wards with up to 22 beds to a 100% single-room configuration. The new facility was funded under the UK’s Private Finance Initiative (PFI), where a consortium of constructors, banks, facilities management operators and the local NHS Trust combine to design, build and operate a new hospital.

An important focus for the organisation – the local NHS Trust – was on recruiting new people to manage the transition. Experienced individuals at both the board level and the project level were hired. A new executive team was brought in following a high profile infection scandal and removal of a majority of the existing board in 2008. Finally, a team was established, including a number of new recruitments, to manage the PFI relationships with the rest of the consortium.

	Pembury, UK	Voorhees, USA	Royal Jubilee, Canada
Primary drivers of change	<ul style="list-style-type: none"> • Increase quality of acute care • Modernisation of old facilities • Infection control • Reconfiguration of service provision across the Trust 	<ul style="list-style-type: none"> • Demographic changes (growth in demand for women & children services) • Introduction of new technology • Process improvement 	<ul style="list-style-type: none"> • Demographic growth (65+ population) • Staff retention • Energy efficiency • Modernisation of old facilities.
External context	<ul style="list-style-type: none"> • Community and local political resistance to reconfiguration of some services. • High profile subject to media scrutiny, partly due to earlier infection control scandal 	<ul style="list-style-type: none"> • Competitive healthcare market, other local providers in direct competition. • Engaging local media as marketing strategy 	<ul style="list-style-type: none"> • Generally supportive but subject to media scrutiny
Additional changes and complexities	<ul style="list-style-type: none"> • Service reconfiguration across the area served by the Trust to focus on acute services in one place. 	<ul style="list-style-type: none"> • Introduction of new electronic medical records systems 3 months prior to opening new hospital • Forms part of an organisation-wide process improvement programme 	<ul style="list-style-type: none"> • Incremental introduction of new electronic medical records system before, during and after opening of new facility
Training and education	<ul style="list-style-type: none"> • Change management and leadership training for middle and senior managers across the whole trust. • Orientation and basic training for all staff 	<ul style="list-style-type: none"> • Continuing process improvement training for selected individuals to become Six Sigma agents • Management engineers organised ‘Move day’ drills and simulations • Orientation and basic training programme for all staff 	<ul style="list-style-type: none"> • External consultant sought to advise on training and education programme. • Hands on (in building) training for all frontline staff
Timescale of move from old facilities	<ul style="list-style-type: none"> • Two-phased move into new building over period of 9 months 	<ul style="list-style-type: none"> • Single ‘move day’ for all services 	<ul style="list-style-type: none"> • One phase of move in one days but incremental technology implementation afterwards
Use of human resources	<ul style="list-style-type: none"> • Development team created to manage the design, construction and finance • Project managers seconded from each clinical division to lead implementation 	<ul style="list-style-type: none"> • Core site team comprising existing management team for the part of the organisation moving to the new facility • Facilitator- six sigma agents (trained in process improvement) and management engineers leading change implementation with the core site team 	<ul style="list-style-type: none"> • Project management team created external to existing organisational structure

Table 1: Case study change management approaches comparison.

Virtua – Voorhees Hospital, New Jersey, USA.

This project involved the construction of a new 398 bed hospital on a greenfield site to replace one of several hospitals (Voorhees) owned by Virtua, a private sector healthcare provider in northern New Jersey. The focus of this hospital is on women's and children's services. Based in a competitive local health market, Virtua wished to replace the old hospital, mainly comprising semi-private (2-bed) rooms or bays, with a new state-of-the-art all-single bedroom facility. The organisation operates on a non-profit basis and financed the new facility internally.

At this organisation there was a special focus was on process improvement. The transition to the new hospital formed part of Virtua's programme to re-engineer its business processes using tools such as Six Sigma, Lean and Change Acceleration Process. This had been started before the new hospital was planned, helping to inculcate a culture of process change and continuous improvement across the organisation.

Royal Jubilee Hospital Patient Care Centre, Vancouver Island Health Authority, Canada.

The project involved the construction of a new 500 bed, 83% single room, inpatient facility to accompany a diagnostics and treatment centre completed in the early 2000s on an existing brownfield site. This was designed to replace an outdated 612 bed facility, comprising mainly 4/6 bed bays. The new facility was

funded under a public-private financing partnership, similar to the Pembury model.

At this organisation, a dedicated project team absorbed most of the burden of change management including infrastructure and stakeholder engagement issues. This team took on responsibility for training and educating frontline staff, therefore circumventing and reducing the workload of general managers.

The impact of different change approaches

Stakeholder engagement

The difficulty of transformational change in health-care has long been acknowledged, with a lack of engagement from stakeholders cited as a key reason for limited success (e.g. McNulty and Ferlie, 2004). The literature on 'social influence' focuses on a top-down cascade model of engagement with middle managers, where senior managers influence those directly below them in the hierarchical layers. Middle managers are often criticised for breaking the chain of engagement through a lack of time, influence or commitment (Birken et al., 2012). Our analysis shows how more innovative strategies for engaging frontline employees and other stakeholders were employed across our case studies.

Figure 1 shows an overview of the different strategies used by the three hospitals, comparing their approaches to stakeholder engagement. In each hospital the pyramid represents the organisational hierarchy, with top management (those concerned with the overall strategic direction of the organisation), middle managers (those concerned with the operational day to day general management of the hospital) and frontline staff (who perform the clinical and non-clinical work in the new facility and will be directly affected by the change). The arrows represent the organisations engagement priorities and the horizontal lines represent intentional (solid) or unintentional (broken) limitations of engagement. So for example, in Pembury the

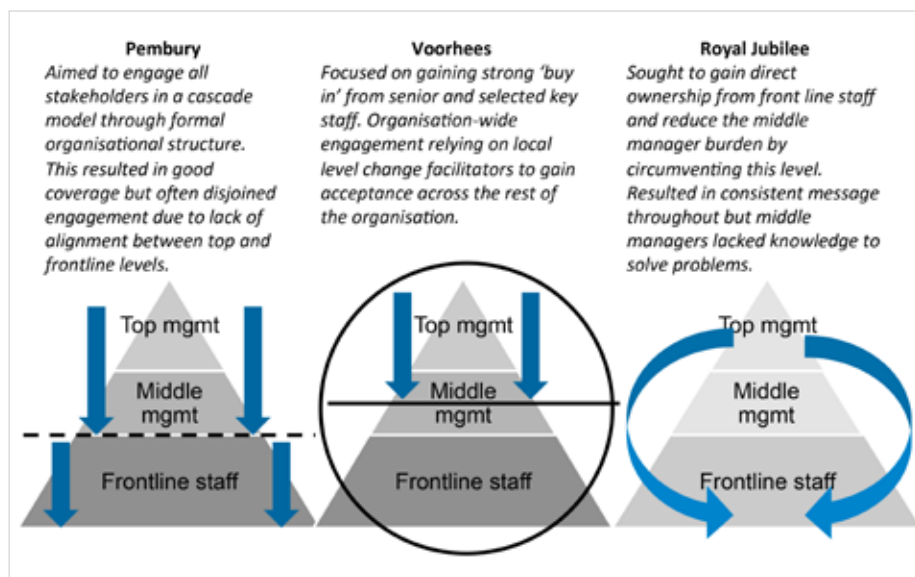


Figure 1: Approaches to stakeholder engagement.

priority was to engage from the top equally through all levels. However, these engagement activities reached a barrier at the middle management level, so another stream of engagement activity took place from middle management downwards.

At Pembury, the organisation used a ‘cascade model’ of information dissemination, using the existing clinical divisional structure and existing communication pathways to disseminate change information. A project office was created to handle the infrastructure aspects of the change. This office included members of the construction company, a programme board given the task of change management and a move and migration team responsible for the ‘move day’ logistics itself. In response to a perceived lack of engagement from clinical divisions, links between the project team and the division were created 18 months prior to the transition.

“[referring to the creation of the project manager roles for each clinical division]...the PFI project was fairly well developed at that time and they wanted to make sure that it continued to be successfully delivered [at the frontline level], so some very peculiar management arrangements were put into place at that time, because there was no representation as such from the Trust.”

(Pembury – Middle manager)

“[The project office was] also very much encouraging locally each department division to supplement [organisation-wide communications], to complement that with much more local personal issues.”

(Pembury – Senior manager)

The objective of the organisation’s internal stakeholder engagement strategy was to make use to a large extent of the existing communication channels and structure of the organisation, which was divided into four divisions. A team consisting of a doctor, a nurse and an operations manager led each division and they were later joined by a project manager specifically to deal with the change management. These project managers were responsible for creating a link between the project office and

the divisional leaders. Some of these links were stronger than others (see section 4.2 below) and in some areas resulted in a lack of alignment between senior management strategies and the understanding and implementation of these strategies by frontline staff.

“We’re trying to assert a cascade of communication, which does not work well at all. So, we rely on a lot of communications directly accessible to all staff... briefing our directors and managers with instruction that they share and personalise, if you like, the messages that we’re pushing down. I think we’re still early days of making that work well.”

(Pembury – Senior manager)

Nevertheless, very few instances of a total lack of engagement or knowledge were reported by the organisation, suggesting that by using these existing channels and structure messages were getting through.

At Virtua, the organisation focused on developing early on a culture of process improvement and organisational readiness, seeking to minimise the impact of changes associated with the transition. This was achieved by adopting a process improvement culture and a culture of constant change and improvement at local levels across the organisation.

“... the culture at Virtua, I think, really drove the success of everybody being involved in it, without a question.”

(Voorhees – Middle manager)

These process improvements were facilitated by the use of tools and philosophies such as Lean, Six Sigma, Change Acceleration Processes and process engineering. Specially trained process improvement experts (see section 4.2 below) were deployed throughout the organisation, working on specific process improvement and re-engineering projects. This approach resulted in high commitment and ‘buy in’ from senior management and selected individuals, but this was manifested less strongly by the majority of the workforce.

“We had some ambivalence within our own team saying, okay, I’m not sure it’s going to work. We’ve been doing it this way, how’re we going to get people to do it that way.”

(Voorhees – Frontline manager)

“I think the bigger benefit there is just in the acceptance and driving the culture and getting everybody kind of moving in the same direction.”

(Voorhees – Senior manager)

Our data showed that although the organisation was able to reach a wide variety of employees with these techniques, there still existed pockets of resistance from those more indirectly impacted by change.

“I mean, there were staff involved from almost every department, it was really a Virtua system-wide approach.”

(Voorhees – Middle manager)

“I’ve heard a number of people on other campuses make off-hand comments about [how] we can’t get this fixed or upgraded or spend money on what we want to do here, it’s all going to the new hospital.”

(Voorhees – Middle manager)

“And doctors are hard to convince, the talk I heard earlier on was you’ll never build this, even when steel was going up they didn’t believe we were going to build it.”

(Voorhees – Senior manager)

Finally, at Royal Jubilee, the organisation created an ‘all powerful’ project office which was detached from the main organisation. The objective was to relieve the workload of operational middle management staff who are traditionally burdened by change implementation (Balogun and Johnson, 2004) and create a direct link to motivate frontline staff.

“Our target audiences were all the front-line staff and those people who were providing the hands-on care; porters, the building’s maintenance guys, the protection services guys, those sorts.”

(Royal Jubilee – Consultant)

The members of the project team were appointed according to their project management and change management skills, and encouraged to develop these further as part of a long term strategy for future change projects by the organisation. This circumvention approach resulted in high levels of motivation and consistent engagement from frontline employees in the run up to the transition but less support from middle managers (although also seemingly less work overload and stress).

“[the approach was] to work with all the [frontline] users, anybody that is going to provide any type of care or service, and get them all working together, rather than in silos, and operationalize the building [to get it ready].”

(Royal Jubilee – Project team)

“...small café sessions that introduced [frontline staff] to the space, and it’s to introduce them to the different technologies. They were highly engaged”

(Royal Jubilee – Consultant)

“But [middle] manager level, no. They were invited to attend the sessions, and several of them did for that hands-on piece, but in terms of a targeted training for them, there wasn’t anything done, no.”

(Royal Jubilee – Consultant)

However, once the facility was built the project team disbanded and moved onto the next project, problems with the new building or service design became the responsibility of the operational middle managers. These middle managers lacked the background knowledge of the design decision-making processes

(i.e. the underlying principles of why parts of the system were designed in a certain way to support new work practices), instead, middle managers used their experience from the former environment as a basis for problem solving and decision making which led to attempts to return to previous ways of working.

“...so even though we spent all this time on the units before, and talked it through the systems and had trained the way the units were set up... what we saw was that people were very quickly trying to replicate the old order in the new environment.”

(Royal Jubilee – Project team)

Change agents and project teams

Within the organisational change literature there are many assumptions about ‘change agent’ roles and how these should be enacted. Our analysis suggests that the case studies used change agents to facilitate and encourage change in different ways by carefully positioning them within the organisation or by emphasising a particular role (e.g. as motivator, connector or facilitator of change). Table 2 shows the types of agents used by each case study.

Different branches of the research literature on change agents favour different terms and definitions (Bamberger, 2008; Parry, 2003; Chreim et al., 2012) but essentially the characteristics of successful change agents include a combination of passion and persistence, and interpersonal skills to facilitate change and influence others. These individuals encourage teambuilding and communicate meaning to professional groups through networks which cross formal and informal boundaries (Birkinshaw et al., 2008; Hendy and Barlow, 2012; Schon, 1963; Soo et al., 2009). They actively promote and enable change for the good of the organisation and in doing so contribute to its success (Dopson et al., 2010; Greenhalgh et al., 2004; Locock et al., 2001).

At a practical level it is often assumed that the outcomes of appointing change agents are predictable, predominantly positive and relatively simple to achieve (Schon, 1963; Hendy and Barlow, 2012; Greenhalgh et al., 2004). The complexity of the role is often underestimated both in the literature and in practice, because we do not understand how organi-

sations use change agents and differentiate responsibilities and position in the change process, especially when this position is temporary. Briefly, organisational literature distinguishes between the following roles and activities:

- **Change agents** – Encourage readiness for change in others and facilitate the change process during its implementation (e.g. Rogers, 2003).
- **Champions** – Actively and enthusiastically promotes innovation and change to others; identify with the idea personally (personal commitment), beyond normal job requirements (Howell and Shea, 2001; Schon, 1963).
- **Boundary spanners** – Perform a linking function that bridges and facilitates communication and coordination between internal members of the group or organisation across professional boundaries (e.g. Williams, 2002).
- **Knowledge brokers** – described as “The human force behind knowledge transfer, finding, assessing and interpreting evidence, facilitating interaction and identifying emerging research questions” (Ward et al., 2009).

	UK Pembury	USA Voorhees	Canada Royal Jubilee
Who?	Divisional Project Managers (DPMs)	‘Black belts’ and management engineers	PCC Project Team
Placement	Link between the project office and Executive and Divisional User Groups	Management – co-ordinating local networks	External to management structure – project office
Role	Boundary spanners / knowledge brokers	Change agents (facilitators)	Champions

Table 2: Change agents’ placement and role in the case studies.

The organisation’s chosen type of agent reflects their strategy for engagement with staff. At Pembury, four ‘project managers’ were recruited to translate operational procedures from the hospital design to the clinical divisions which would be working in the new facility. They were positioned between the ‘New Hospital Development Team’ who were managing the build and the four clinical divisions within the Trust. The way this role was enacted is best characterised as a boundary spanning or knowledge broker role as the main tasks involved filtering and translating communications and facilitating dialogue between relevant groups. These individuals were relied on heavily to cascade messages throughout the formal

organisational hierarchy (see figure 2). However, this resulted in bottlenecks when communication flows became busy. This approach also relied heavily on the effectiveness of selected individuals, and results were therefore mixed:

“I perhaps would question whether they’ve got [the right personal skills] if I’m honest.”

(Pembury – Senior manager).

“Without a doubt I think there is a real lesson in the type of person that you have in the role...some of the individuals in those roles have been far better at it than others. Some have been better at that liaison role back with their own divisional teams than others, and some reached out across into the other parts of the organisation better than others – there wasn’t consensus about what was the priority of those individuals.”

(Pembury – Middle manager/Project manager)

At Virtua, the organisation relied heavily on process improvement specialists to inspire the culture of change they sought to create. They used their own management engineers and ‘black belts’ to harness the organisational culture and bring about change, and were resistant to bringing ‘outsiders’ into the organisation:

“Most organisations, when building, have consultants all over the place. We pretty much use our engineers and our black belts to do the whole design specification implementation.”

(Voorhees – Senior manager)

“If we had had an outside company come in and do it for us they wouldn’t have understood our culture. They wouldn’t have understood the things like the switches and the leverage you have to get people to do things, because a lot of times consultants come in and tell you what you already know.”

(Voorhees – Senior manager)

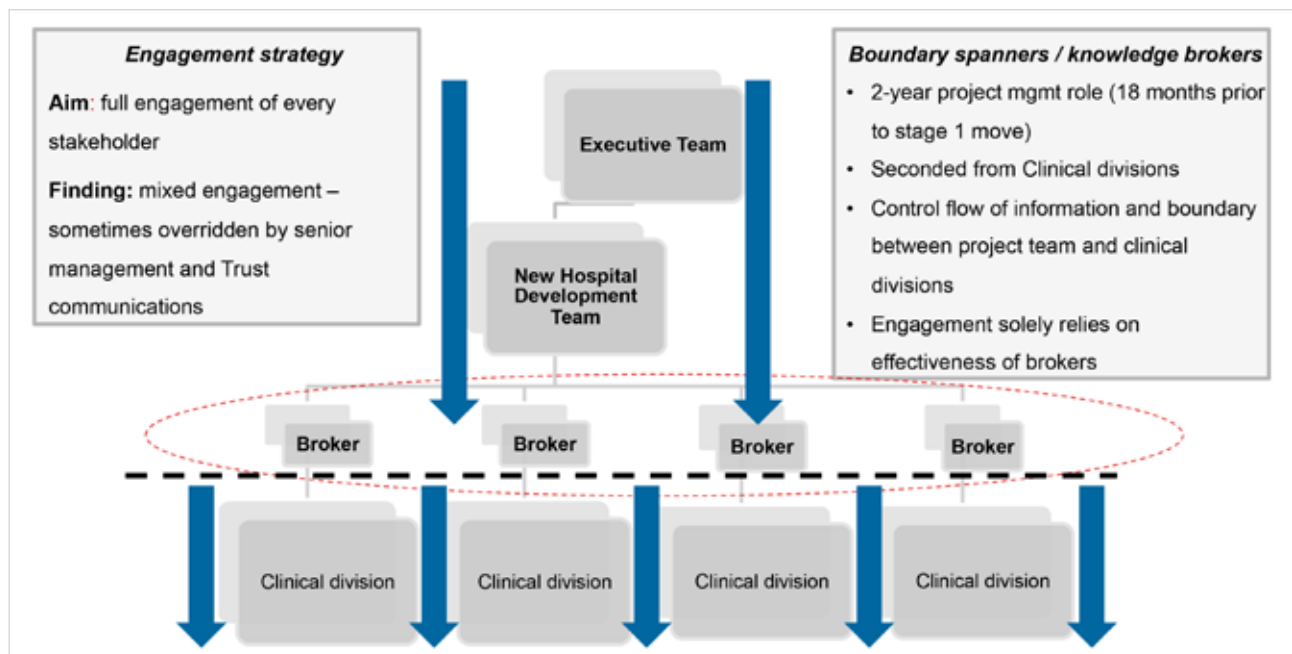


Figure 2: Engagement strategy and use of change agents at Pernbury, UK.

These agents used their process skills to facilitate change at a local level, introducing smaller operational projects which could be incorporated into the overall programme. For example, they unpacked and redesigned clinical processes and management processes at the frontline level and integrated this into a whole system redesign for the new hospital. They used the management tools which already formed a big part of the organisation’s culture to drive change (see figure 3, where ‘organisational culture’ is represented by the circle).

“The culture of the organisation allowed us to go there. We were an organisation that was used to tools.”

(Voorhees – Senior manager)

“When you’re looking at the change management, the ability to forge ahead with strategy is really all about the culture. You know, somebody once said, culture will eat strategy every time. And I think that’s true. So you can have the best strategy, but if you don’t have the culture for performance and the belief to execute, I don’t think it’s going to happen”

(Voorhees – Senior manager)

At Royal Jubilee, the external project office acted as the champion of change. Members of the project office sought to empower and motivate frontline staff and all the project managers had a strong personal commitment to the organisation and the changes being made. Members of the project office emerged from the organisation as champions and were selected and nurtured in their project role. As noted above, the strategy for engagement was to make use of frontline staff to drive the change and therefore the project team champions targeted frontline clinical staff, with middle managers expected to buy-in later to the process:

“I think as they move in and function, that the middle managers will buy in. The frontline clinical staff, they were heavily engaged”

(Royal Jubilee– consultant)

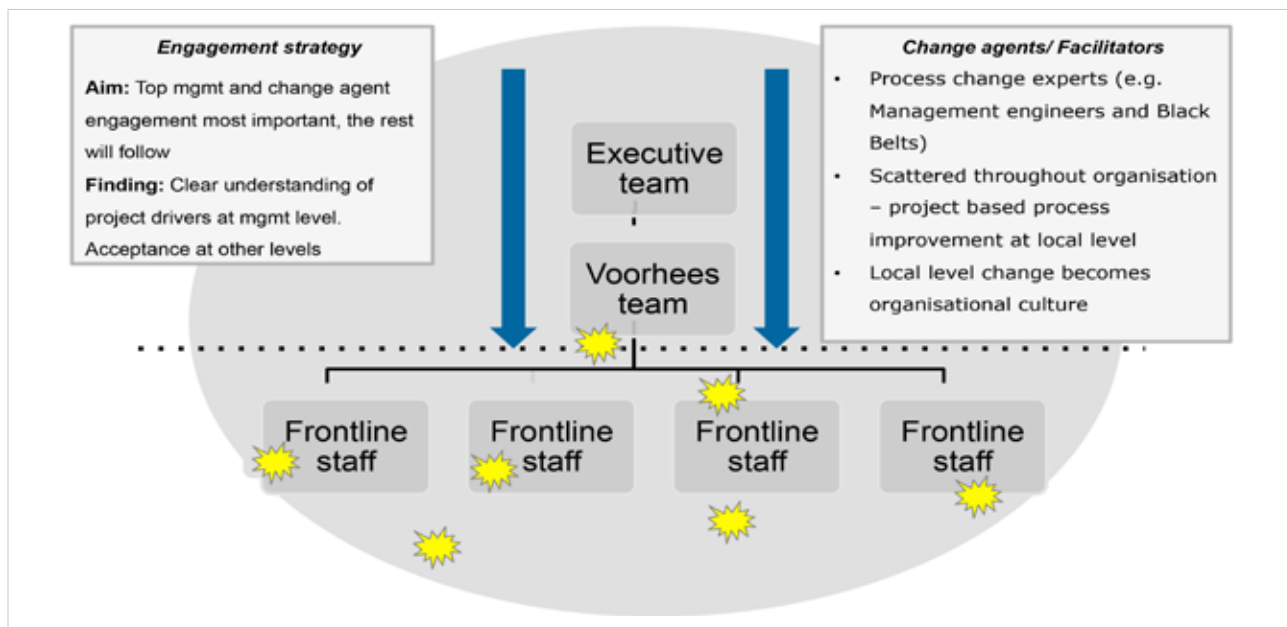


Figure 3: Engagement strategy and use of change agents at Virtua, Voorhees Hospital, USA.

This strategy was effective in creating enthusiasm and momentum from frontline staff, who became highly engaged, and there was good coherence between the strategy from top and bottom:

“I think that how staff are feeling now is excited. I think a couple of weeks ago they were scared to death.”

(Royal Jubilee – senior manager/project team)

“And so I’m kind of going wow, we’ve got a bottom-up and a top-down approach that’s also very congruent.”

(Royal Jubilee – Senior manager/Project team)

Integration of change aspects and adaptation of new processes

It was clearly essential for hospital staff to understand why the new facilities had been designed the way they had, in order to ensure that new work processes were successfully adopted.

At Pembury, the project management team focused on the infrastructure and the change was led from the programme board situated in this team. As the design of the new hospital progressed, the Trust became aware of a gap between this group and service delivery changes, the responsibility of the divisional teams. A new ‘boundary spanning’ divisional project manager role was created to address this gap.

Although the creation of this role may have mitigated some of the problems in coordinating the redesign of work practices and the infrastructure design, some saw this as ‘too little too late’. Staff reported that it was only after they had moved into the new building that they truly understood the extent to which they needed to change their operational processes. During the initial period following the move frontline staff and unit leaders had to make many adjustments to the ways they delivered care in the new environment:

“We did think for the first few weeks that we were here, that we would never settle down. We wouldn’t be able to adapt to the way that we were working. And we were saying we need more nurses. But when we thought about it we didn’t actually need more nurses, we needed to change. So we adapted the way we worked.”

(Pembury – Frontline staff manager).

The approach at Voorhees was that work process redesign across the organisation was the main driver of infrastructure decisions. The organisation was very proactive in identifying potential work practice changes and linking the aspects of design throughout the organisation. The design of the new facility was only established once the work processes has

been decided. They made considerable efforts to pilot and trial all the new processes both in simulations and ‘real life’ enactment in mock-ups. The organisation used its own in-house team of management engineers and ‘black belts’ to meticulously plan the optimum ‘move day’ scenarios,

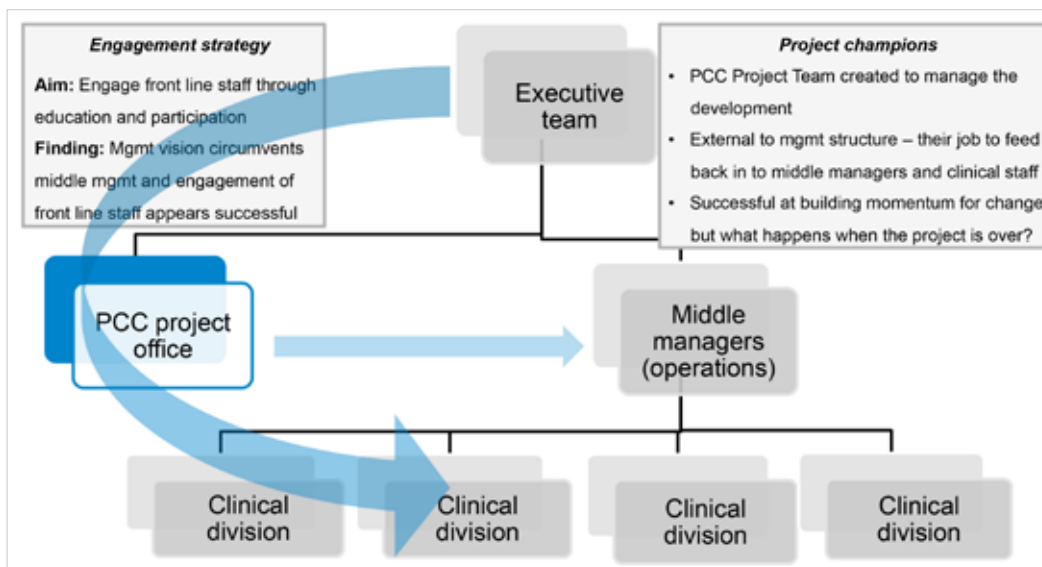


Figure 4: Engagement strategy and use of change agents at Royal Jubilee, Canada.

involving simulations and drills with staff and actors as patients. This helped to increase acceptance of the move to the new hospital as it exposed to staff the problems of working with new processes in a suboptimal environment in the old hospital – it was therefore seen as a relief for them to move. This was clearly seen in the mother and baby unit, where nurses simulated how they would deal with care differently in the new building whilst using old processes in their actual work:

“We did change our process for after a baby’s born, how we care for the mom and baby together, and we were able to simulate that at the other (old) hospital. I think that was really a good thing, because it’s just been accepted... They did a pilot there, but because they couldn’t make the infrastructure changes, they couldn’t really sustain it over there...but through simulation we were able to get people comfortable with it and it hasn’t been that much of an issue here.”

(Voorhees – Middle manager)

Compared to Pembury, Voorhees interviewees reported fewer instances of resistance to new processes and a good understanding of the necessity of the new environment. This resulted in a smoother transition period and fewer unexpected problems. However, this approach represented a considerable investment in time and money, for example in numerous large-scale drills and simulation activities.

There was also limited flexibility in the infrastructure and service delivery processes once the move had taken place. Only minor adaptation of work processes or tweaking occurred, in comparison to considerable adjustment in the other case studies once the ‘reality’ of the move became apparent. In some instances employees reported not being able to make changes to work processes which they found not optimal when faced with higher volume of patients than in simulations.

At Royal Jubilee, the project office was very effective at managing the integration between service redesign and infrastructure aspects of the transition in the planning stages. This resulted in effective training of frontline staff on how to use equipment and they were able to minimise the immediate impact

of the change. Interactive mock-up sessions where employees could practice certain procedures in the new environment were seen as particularly valuable.

However, 2–3 months after the transition (after the project team had begun to disengage from the management of the new facility) it became apparent that there was a gap in understanding the philosophy and reasons behind some aspects of the design and the way in which they were being used. By concentrating decision making on a small number of individuals, a disconnect between the design rationale and practice emerged, which became difficult to resolve.

An example is the way specialist areas were built into each ward space for physiotherapy and rehabilitation treatments. Previously these assessments (e.g. heart patients demonstrating ability to walk up a flight of stairs before discharge) had been carried out in the patient bays or corridors. The rationale behind this addition was that new rehabilitation treatments or assessment techniques, for which there was insufficient space in the old facility, could be carried out with the latest equipment. However, for the first few months, employees continued to try to use old treatment and assessment processes and complained that they did not have space to perform these tasks because they no longer had access to a stairwell to assess heart patients. Whilst the visualisation of how service redesign and the infrastructure changes worked together was clear for the senior management, frontline staff who were still carrying out old processes until the morning of the move, struggled:

“The main staff issues are about [how] we used to be able to do everything differently over there [the old facility] and we don’t have the space to do it in the same way and it’s not recognizing that we’re trying to blow up what we did. It’s like how can we do it in the space now, the space is different?”

(Royal Jubilee – Frontline manager)

Conclusions and recommendations

During the change management process we observed three very different approaches in our hospitals. Pembury essentially adopted a problem-solving approach, identifying and responding to the myriad of events arising from the constantly

changing NHS environment and modifying their plans accordingly. They demonstrated an ability to be internally critical, recognise their shortcomings and be flexible in resolving these issues. At Voorhees a highly proactive approach was taken, planning for as many contingencies as possible in advance. Staff worked hard to ensure that their decisions were well researched and tested. At Royal Jubilee a fully-integrated approach which used a dedicated group of staff to combine both the infrastructure and work practice aspects of the hospital redesign enabled a highly consistent strategy across the organisation.

Despite the different approaches, all three organisations completed the transition to the new hospital, largely in line with their stated objectives and on time. All three also experienced challenges in the immediate aftermath. Table 3 summarises the advantages and disadvantages of each of the strategies adopted by our case studies.

Case Study	Advantages	Disadvantages
Pembury, UK	<ul style="list-style-type: none"> • Clear model for communications strategy • Frontline staff receive information from direct superior 	<ul style="list-style-type: none"> • Bottlenecks in information flow (need to prioritise messages) • Relies on skills of brokers
Voorhees, USA	<ul style="list-style-type: none"> • Wide diffusion of information (fast) • Supported by overall organisational culture 	<ul style="list-style-type: none"> • External pockets of resistance • Information overload
Royal Jubilee, Canada	<ul style="list-style-type: none"> • Direct engagement of staff • High momentum 	<ul style="list-style-type: none"> • Loss of knowledge when project office detach • Middle management disengagement

Table 3 – Impact of different change management strategies.

This study demonstrates that there is no ‘one size fits all’ template for organisations engaged in this type of complex services and infrastructure change. The decisions and approaches adopted by organisations in managing transformations of this scale are influenced by a variety of contextual factors, all of which have an impact on the acceptance, momentum and facilitation of change. Important factors in reducing the detrimental effects of the transition to the new hospital were:

- The need for continuity of vision and appropriate translation of strategy across the whole organisation. We have discussed the impact of a lack of alignment between levels of engagement and between project teams and clinical staff. We found that where a lack of alignment between different aspects of change developed this had implications for the efficiency of work practices because it was

easier to change a practice than the infrastructure. Organisations therefore need to work hard to ensure transparency in decision-making and rationale behind decisions, as well as the practical knowledge of work processes.

- The retention of change-specific knowledge and the rationale for decisions that were taken needs to be a priority, especially if it has been limited to key individuals. This helps to ensure that future decisions regarding the modification of work practices after the transition continue to support the objectives of the overall organisational strategy. In addition, transferable change management and project management skills which are developed during the transition are useful to the organisation more widely and should be valued as a future investment for the organisation.
- It is important to understand that major work practice redesign and infrastructure change represent

two different extremes in transition planning within organisations. Large scale change involving organisational restructuring has been found to create psychological strain in employees due to uncertainty (Bordia et al., 2004), with the redesign of work processes potentially leading to burnout and emotional exhaustion (Ginsberg and Venkatraman, 1995, Dopson et al., 2008). Managers involved in major hospital reconfiguration programmes need to be aware of the unique challenges which each type of change brings and

the additional difficulties in doing them simultaneously. Strategic planning, approaches to implementation, and training and education all need to consider the skills and resources associated with this, and ensure that all levels of the organisation understand how infrastructure and service redesign interact in the new configuration. It is important to understand which types of agents (champions to create enthusiasm or change agents to ensure consistent implementation) may be needed at different stages of the change and that these may be different individuals with different skills.

This research has provided an insight into how healthcare organisations plan for and implement large-scale change, for example when organisational and infrastructure change are combined. We have illustrated a variety of strategies for planning this

type of organisational restructuring and evaluated the advantages and disadvantages of each. However, further research is needed to examine the relationship between the intensity and type of planning that is needed prior to major change, compared to the degree of flexibility needed to cope with unexpected internal and external factors. We saw approaches which sought to be very proactive in their planning (Voorhees) and approaches which were more responsive (Pembury). Both allowed for contingency but what was less clear is how the organisations achieved this, and the implications of this for employees. Further research should focus specifically on this issue of flexibility.

Finally, whilst all of our case studies could be argued to have been successful in achieving their immediate objectives, we have not explored the costs of change management in relation to financial, time or other factors. Future work could use appropriate benefits realisation techniques at various post-change points to develop rigorous measures of short and long term success.

Acknowledgements

The research was supported by the UK's Engineering & Physical Science Research Council (EPSRC), through the HaCIRIC programme. Our thanks go to all those who participated in the research and the three hospital organisations for their support. The views expressed in this paper are those of the authors.

References

- ANTEBY, M. & MOLNAR, V. 2012. Collective memory meets organizational identity: Remembering to forget in a firm's rhetorical history. *Academy of Management Journal*, 55, 515–540.
- ANTEBY, M. & MOLNAR, V. 2012. Collective memory meets organizational identity: Remembering to forget in a firm's rhetorical history. *Academy of Management Journal*, 55, 515–540.
- BALOGUN, J. & JOHNSON, G. 2004. Organizational Restructuring and Middle Manager Sensemaking. *Academy of Management Journal*, 47, 523–549.
- BAMBERGER, P. 2008. From the editors: Beyond contextualization: Using context theories to narrow the micro-macros gap in management research. *Academy of Management Journal*, 51, 839–846.
- BIRKEN, S. A., LEE, S. D. & WEINER, B. J. 2012. Uncovering middle managers' role in healthcare innovation implementation. *Implementation Science*, 7, 28.
- BIRKINSHAW, J., HAMEL, G. & MOL, M. J. 2008. Management Innovation. *Academy of Management Review*, 33, 825–845.
- BORDIA, P., HUNT, E., PAULSON, N., TOURISH, D. & DIFONZO, N. 2004. Uncertainty during organizational change: Is it all about control. *European Journal of Work and Organizational Psychology*, 13, 345–365.
- CHREIM, S., WILLIAMS, B. E. & COLLIER, K. E. 2012. Radical change in healthcare organization: Mapping transition between templates, enabling factors, and implementation processes. *Journal of Health Organization and Management*, 26, 215–236.
- CORBIN, J. & STRAUSS, A. S. 2008. *Basics of Qualitative research: Techniques and procedures for developing grounded theory*, Thousand Oaks, CA, Sage.
- DOPSON, S., FITZGERALD, L. & FERLIE, E. 2008. Understanding change and innovation in healthcare settings: Reconceptualizing the active role of context. *Journal of Change Management*, 8, 213–231.
- DOPSON, S., FITZGERALD, L., FERLIE, E., GABBAY, G. & LOCOCK, L. 2010. No magic targets! Changing clinical practice to become more evidence based. *Healthcare Management Review*, 35, 2–12.
- GINSBERG, A. & VENKATRAMAN, N. 1995. Institutional Initiatives for Technological Change: From Issue Interpretation to Strategic Choice. *Organization Studies* (Walter de Gruyter GmbH & Co. KG.), 16, 425–448.
- GREENHALGH, T., ROBERT, G., MACFARLANE, F., BATE, P. & KYRIAKIDOU, O. 2004. Diffusion of Innovations in service organizations: Systematic review and recommendations. *The Milbank Quarterly*, 82, 581–629.
- HENDY, J. & BARLOW, J. 2012. The role of the organizational champion in achieving health system change. *Social Science and Medicine*, 74, 348–355.
- HOWELL, J. M. & SHEA, C. M. 2001. Individual differences, environmental scanning, innovation framing, and champion behavior: key predictors of project performance. *Journal of Product Innovation Management*, 18, 15–27.
- JOSEPH, A. & HAMILTON, D. K. 2008. The Pebble Projects: Coordinated evidence-based case studies. *Building Research and Information*, 36, 129–145.
- LINES, R., SELART, M., ESPEDEL, B. & JOHANSEN, S. T. 2005. The production of trust during organizational change. *Journal of Change Management*, 5, 221–245.
- LOCOCK, L., DOPSON, S., CHAMBERS, D. & GABBAY, J. 2001. Understanding the role of opinion leaders in improving clinical effectiveness. *Social Science and Medicine*, 53, 745–757.
- MABEN, J. et al. 2015a. Evaluating a major innovation in hospital design: workforce implications and impact on patient and staff experiences of all single room hospital accommodation. *Health Serv Deliv Research* 3(3). DOI: 10.3310/hsdr03030.

MABEN, J. et al. 2015b. One size fits all? Mixed methods evaluation of the impact of 100% single room accommodation on staff and patient experience, safety and costs. *BMJ Quality & Safety*. DOI:10.1136/bmjqs-2015-004265.

MARCH, J. G. & SHAPIRA, Z. 1987. Managerial perspectives on risk and risk taking. *Management Science*, 33, 1404–1418.

MCNULTY, T. & FERLIE, E. 2004. Process transformation: Limitations to radical organizational change within public service organizations. *Organization Studies*, 25, 1389–1412.

MOONEY, H. 2008. Single rooms: A blueprint for better care? *Nursing Times*, 104, 14–16.

NHS 2008. The development and implementation of NHS treatment centres as an organisational innovation. National Institution for Health Research.

PARRY, J. 2003. Making sense of executive sensemaking: A phenomenological case study with methodological criticism. *Journal of Health Organization and Management*, 17, 240–263.

POELS, T., KLEIN HESSELINK, J. & KIELEMA, J. 2011. *Rhythmics of Organizational Change: Nine case studies in change management*, The Hague, The Netherlands, Academic Service.

ROGERS, E. M. 2003. *Diffusion of Innovations* (fifth edition), New York, Free Press.

SCHON, D. A. 1963. Champions for Radical New Inventions. *Harvard Business Review*, 41, 77–86.

SOO, S., BERTA, W. & BAKER, R. 2009. Role of champions in the implementation of patient safety practice change. *Healthcare Quarterly*, 12, 123–128.

ULRICH, R. S., ZIMRING, C., ZHU, X., DUBOSE, J., SEO, H., CHOI, Y., QUAN, X. & JOSEPH, A. 2008. A review of the research literature on evidence-based healthcare design [Online].

WALSTON, S. L. & CHADWICK, C. 2003. Perceptions and Misperceptions of Major Organizational Changes in Hospitals: Do Change Efforts Fail Because of Inconsistent Organizational Perceptions of Restructuring and Reengineering? *International Journal of Public Administration*, 23, 1581.

WARD, V., HOUSE, A. & HAMER, S. 2009. Knowledge brokering: the missing link in the evidence to action chain? *Evidence and Policy*, 5, 267–279.

WEICK, K. & QUINN, R. E. 1999. Organizational change and development. *Annual Review of Psychology*, 50, 361–386.

WILLIAMS, P. 2002. The Competent Boundary Spanner. *Public Administration*, 80, 103.

YIN, R. 2009. *Case Study Research: Design and methods* (fourth edition), Thousand Oaks, CA, Sage.

YOUNG, P. & YARANDIPOUR, R. 2007. Examining the case for single rooms. *Health Estate Journal*, 85–86.

Appendix: Data collection and analysis

Data comprised 155 interviews complemented by the analysis of 205 documents (including internal minutes and reports, publicly available reports and research, and media coverage) and field notes from 36 hours of observations (including new and old hospitals tours, informal research observations and impressions, formal mock up days and meeting observations) (see table 4). Data were collected by the research team over two phases for each case study. By using a variety of data sources we were able to gain a holistic picture of the case study and its context from a variety of perspectives (Yin, 2009).

Initial interview participants were selected with the help of a lead contact within each of the organisations. These included key members of senior management (who made strategic decisions about the reconfiguration), middle managers (who were predominantly responsible for the

implementation) and frontline staff (who enacted the new processes and worked in the new infrastructure). In phase 1 our focus was on the strategic aims of the reconfiguration, business models used, drivers and historical context. At the second phase (approximately three months after the reconfiguration) our focus was on the immediate impact of the reconfiguration and evaluation. The interviews were conducted by two researchers and analysed by three researchers, providing an opportunity to cross check impressions and interpretations.

Data Source	Pembury (UK)		Royal Jubilee (Canada)			
	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
Formal interviews:	22	42	28	14	24	25
Observations (hrs):	7	8	10	4	4	3
Documents:	53	63	41	17	10	21

Table 4 – Data collection

Interviews were transcribed and analysed by the research team at different levels allowing for constant comparison between the data and the findings (Corbin and Strauss, 2008). Initially, an historical context of each case study was derived. At the first coding stage we used an open coding approach to identify concepts relating to strategies, attitudes and beliefs about organisational reconfiguration planning and impact. These open codes were then compared for similarities and differences to create conceptually similar groupings. We were then able to create more distinct higher order

categories addressing the types of challenges which the organisations faced, which we then compared to the original transcripts for verification. These categories were summarised in relation to our theoretical framing and are presented in this report. At each stage of the analysis, members of the research team met to discuss interpretations of the findings, compared analysis and discussed any inconsistencies. There was broad agreement in our interpretations throughout the process and any inconsistencies were addressed by referring back to the original transcripts. □

Authors



Professor James Barlow, has held a Chair in Technology and Innovation Management (Healthcare) at Imperial College Business School since 2003. Since September 2013 he has also been Associate Director of Research and Evaluation for Imperial College Health Partners. He was co-director of the Imperial College's Innovation Studies Centre from 2003–2006. From 2006–2013 he led HaCIRIC, a major programme of research on the adoption, implementation and sustainability of innovation in healthcare infrastructure systems. Much of James' research and practice has been on the development and introduction of complex healthcare technologies, as well as organizational and financial innovations such as public-private partnerships. He has published widely and has been a member of many expert panels on healthcare innovation, both in the UK and internationally.



Dr Jane Hendy is a Senior Lecturer in the Health Care Management & Policy Department in Surrey University Business School. Jane previously held positions at Imperial College Business School and the London School of Hygiene and Tropical Medicine. Jane's work intersects healthcare and mainstream management, and she has published widely across both domains. Her interests are concerned with organisational change, leadership and innovation management. Jane's current work includes knowledge translation across international cultures, developing concepts of innovation readiness and the examination of corporate hubris.



Dr Danielle Tucker Danielle Tucker is a Lecturer in Management at the University of Essex. Before joining Essex Business School (EBS), she held Post-Doctoral positions at the London School of Economics and Political Sciences (LSE) and Imperial College, London, UK. She completed her PhD in Management at the University of Kent, UK. Her research interests focus on organisational change management, change communications and organisational trust, with a special interest in healthcare sector organisations. Danielle's research looks at the experience of employees during organisational change. In particular her research has considered the interpretive processes and communication strategies of various key change management players. Danielle's work draws upon the literature of organizational behaviour and organizational psychology. She has published her work in *Management Communication Quarterly*, *Journal of Organizational Change Management*, *Journal of Business Ethics*, and the *Academy of Management Proceedings*.



UNDERSTANDING CHANGE

Lichen flourishes in clean air.
Just like good health, good
healthcare design starts
with getting the basics right.
AECOM sees health and
healing in the round.

Please contact:
john.hicks@aecom.com

aecom.com



Buildings, Brains and Behaviour

Towards an affective neuroscience of architecture:

The Hedonic Impact of Sustainable Work Environments on Occupant Well-being

David Techau¹, Ceridwen Owen, Douglas Paton, Roger Fay

The recent alignment of architecture, neuroscience and psychology has recast our understanding of how building design influences people's states of mind. Testable scientific hypotheses open up new avenues for the synthesis of these disparate fields of inquiry. This study draws upon some of the latest research that seeks to understand how hedonic states of pleasure are connected to eudaimonic assessments of meaningfulness within the built environments in which we work and live. Integrating these theoretical perspectives affords an opportunity to hypothesize that 'green' buildings could enrich human experience by promoting psychological and social engagement (eudaimonia) while providing healthier indoor environments that enhance the well-being of its occupants (hedonia). This paper provides evidence to support the intuition that an architecture that sustains the well-being of its occupants will be valued and endure.

Introduction

Across the globe today, forward-looking organizations² are directing significant capital resources to the development of new green-rated, sustainable workplaces. In addition to the objective of reducing environmental footprint, a key imperative is the ability to tap into a vast reservoir of human potential by promoting and sustaining the health and well-being of people through exceptional indoor environmental quality (IEQ). In pursuing the latter, the investment goes beyond the building per se to include the introduction of major 'change' initiatives aimed at preparing employees to work more effectively in open, flexible, team and activity-based work settings. Moreover, in the midst of all this, they are radically restructur-

“Change the environment,
change the brain,
change the behaviour.”

Fred Gage, PhD, neuroscientist
Salk Institute for Biological Studies

ing the way work is being done in their organizations. Hence, this investment also seeks to facilitate more effective adaptation to restructuring.

However, the extent to which these new types of green workplaces are affecting the psychological well-being of their occupants (for example, sustained well-being, and greater adaptability) is unknown. There is a dearth of empirical evidence linking the physical features of sustainable work environments to positive social, psychological, behavioural, or neurological outcomes. While work has been directed to the relationship between environment and psychological states (though not to date, on green buildings) less is known on its influence on brain functions. In this paper, we argue that new discoveries in the neurosciences can help us bridge conceptually, the gap that exists between our understanding of the relationship between the built environment and the social and psychological experience of those who are required to work there.

The Neuroscience of Architecture and Well-Being

New research emerging out of the neurosciences is challenging our preconceived notions about how the physical environment affects our sense of well-being. Dr. Fred Gage was part of a group of

scientists that discovered ‘neurogenesis’ or, the process whereby new neural connections are regenerated across the life span through active immersion in enriched physical environments (von Praag, Kempermann, & Gage, 2000). Studies such as these offer ample evidence to support improved brain functions through environmental activity, stimulation and enrichment. If we compare an ‘enriched’ lab rat cage with Camenzind Evolution Architects’ playful, neuro-design of the new Google headquarters in Zurich, we can visualize a similarity to the contemporary workplace.



Fig. 1: Environmental Enrichment – Lab Rat Cage + Google, Zurich

How we feel and act in built environments can be tied to variations in the physical features of those environments. A recent study identified people’s preferences for curvilinear versus rectilinear surfaces and space (Vartanian et al., 2013). More recently, the same research team studied the effects of ceiling height and perceived enclosure, or openness, on aesthetic judgments and approach-avoidance behavior (Vartanian et al., 2015). These studies are exploring the neuroscientific basis of architecture and design.

For example, people’s sense of place and the ability to navigate are two of the most fundamental brain functions. The Nobel prize-winning research of O’Keefe, Moser & Moser (2014) identified ‘grid’ and ‘place’ cells in the human brain that give us our sense of place and serve as a kind of compass and spatial positioning system to help orientate us as we navigate our way through the built and natural environment.

An important contribution to providing evidence-based support for this comes from not relying on subjective self-report data alone. Psychologists and neuroscientists today are employing functional mag-

netic resonance imaging (fMRI) technologies to pinpoint the brain’s hedonic hotspots stimulated by pleasant associations with our surroundings through our senses, thoughts and tasks (Berridge & Kringelbach, 2010). Neurological evidence can play a pivotal role in demonstrating the efficacy of design approaches.

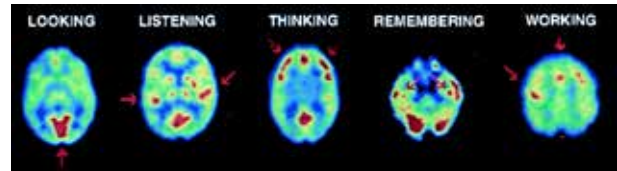


Fig. 2: Hedonic Hotspots. Looking at pleasant sights, listening to pleasant sounds, thinking pleasant thoughts, remembering pleasant memories, working on pleasant tasks (flow)

We can easily imagine all of our hedonic hotspots firing simultaneously if we suddenly found ourselves in a place like Paley Park in New York City. This “oasis of well-being” was highlighted in William H. Whyte’s 1980 book and film: “The Social Life of Small Urban Spaces”. Engagement in an environment high in natural features stimulates the parasympathetic nervous system in ways that counter the stress-related “fight or flight” response to promote a sense of well-being while reducing the risk of stress-related immunological health issues.

These features reveal a biophilic sensitivity to the brain’s pleasure and reward centers. A high (6.1m) waterfall and retention pool provide a backdrop to this pocket park masking the sounds of East 53rd Street. A canopy of trees with green walls, planters, flowers, moveable tables, chairs, bench seating and natural surfaces sets one’s mind at ease. A wonderful aspect and orientation (sun, light and a vendor) and you have many of the positive ingredients necessary for a visitor to achieve a eudaimonic state of neuro-psychological well-being.



Fig. 3: An Oasis of Well-being - Paley Park - New York City – Zion and Breen, 1967.

Investigations such as these are the first conscious steps of a discipline conceived in the boundary blurring union of architecture, neuroscience and psychology.

The Neural Basis of Affect and Design

People attribute meaning to the places in which they live and work. This is captured in how people develop a psychological sense of place attachment (the emotional bond between person and place) and place identity (the relationship between lifestyle preferences and environmental opportunities). The study of meaning is fundamental to understanding the relationship between people and place. John Dewey stated in *The Pattern of Inquiry* (1938, p.330), that: “only those things of the environment that are taken as having connection with and bearing upon this life, enter into the meaning system”.

A place’s influence on our behaviour is mediated by our brain’s interpretation of it. Through a series of cognitive, affective and conative processes, environmental information is used to construct an internal representation of our physical surroundings which, once developed, guides how we interact with elements in that environment. The great pragmatist and one of the founders of modern psychology, William James in his *Principles of Psychology* (1890), put it this way: “Minds inhabit environments which act on them and on which they in turn react” (1890, vol.1, p6). The following figure illuminates his insight and provides an experimental framework for this affective inquiry.

Similarly, the circumplex model is used to explore the neural basis of affect. The circumplex model proposes that affective states arise from two fundamental neurophysiological systems, one related to valence (along a pleasant-unpleasant continuum) and the other to the level of arousal or alertness (Posner, Russell, & Peterson, 2005). People’s affective meanings and interpretations can be analyzed through their placement onto this two-dimensional, bipolar plane. (Russell, 1980).



Fig. 5: A Circumplex Model of Affect (Russell, 1980)

We hypothesize that a zone of optimal well-being and peak human performance will be found in those workplaces that exhibit high positive affect and optimum levels of arousal. A variation of Wundt’s curve illustrates this.

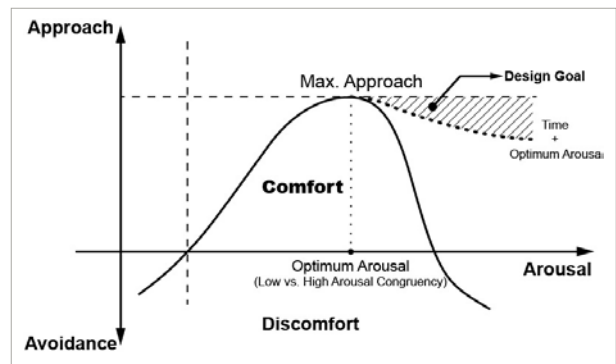


Fig. 6: Hypothetical curve relating maximum approach (high positive affect) with optimum arousal (derived from Wundt, 1874 and Berlyne, 1967, 1973)

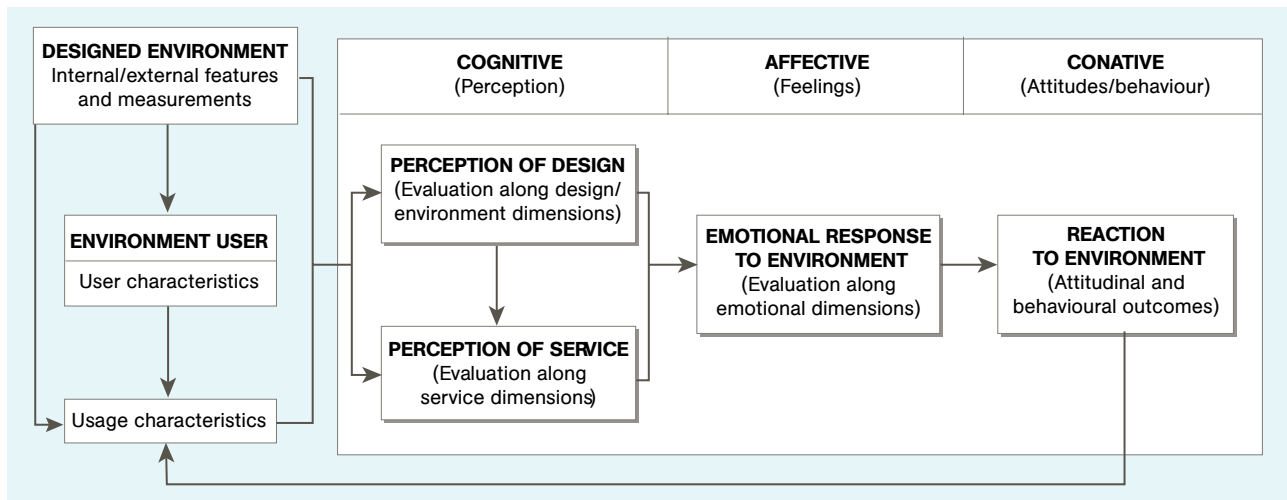


Fig. 4: The Environment-Response Model (after Bitner, 1992).



Fig. 7: The Docklands (Melbourne, Australia)

Subjective well-being (SWB) consists of three parts, namely: the presence of positive affect (PA); the absence of negative affect (NA); and, satisfaction with life in general (Diener, Biswas-Diener, & Tamir, 2004). The focus henceforth will be on the first.

Context/Case Studies

In this paper, we will examine the positive affect that the physical features of green workplaces have on the well-being of occupants in three (3) recently occupied, Green Star rated, premium-grade, commercial office buildings located in the Docklands in the City of Melbourne, Victoria, Australia.

The opportunity to observe the physical changes occurring across three new sustainable work environments provides a distinct vantage point from which to view the evolution of the green workplace. Each of these case studies has been recognized as an exemplar of sustainable workplace design earning world-class, Green Star and NABERS ratings. These two (voluntary) Australian ratings systems are used to assess sustainable design and environmental performance (Green Star) and the ongoing operational and energy efficiency (NABERS) of new office fitouts in green buildings:

- **The Green Building Council of Australia (GBCA),** Green Star, www.gbca.org.au
- **The National Australian Built Environment Rating System, NABERS,** www.nabers.gov.au

A brief overview of each case study site is provided below to set the stage for this inquiry.



Case Study 1 (CS1)

This global company is a leading service provider of information communication technology (ICT) solutions supporting a broad range of industries and enterprises across Australia and New Zealand. Their tenancy is located in a Green Star (Office Interiors V1.1) 6 star Green Star rated building in Melbourne's Docklands. The building was certified and occupied in 2009 and comprises 3 levels totalling 4,518 m² of premium-grade office space housing approximately 350 staff. The tenancy also achieved a 5 Star NABERS rating for energy efficiency.

Case Study 2 (CS2):

The firm, based in Australia and South Africa with a worldwide office network, offers engineering, design, planning, project management and specialized technical services for public and private sector clients. In late 2012, the firm moved into its new, 6 star Green Star rated building in Melbourne's Docklands. The firm's tenancy in the building included the fit-out of some 9,800 m² of premium office space accommodating nearly 700 staff over the top five levels all interconnected by a central open, communicating stair.

Case Study 3 (CS3):

The company is a major private health insurer in Australia. The insurer has recently occupied nearly 46,500 m² of space across 9 levels of their new 'organic' open structure located in Melbourne's Docklands. The facility has achieved a 6-star Green Star rating and a five-star NABERS rating. The building will consolidate and house approximately 1,500 staff from six different locations. The relocation of all staff to the new building was completed in October 2014.

These case studies provide an opportunity to explore some of the latest thinking in sustainable workplace design.

Methods, Findings and Results

This inquiry takes a pragmatic stance utilizing mixed methods to study subjective well-being in green workplaces. Tools of inquiry included semi-focused interviews, building walkabouts, observations, analysis of documents, photographs and floor plans, and the use of an ‘online’ building use survey administered both pre and post-occupancy (CS3). Data from the three case study sites have been combined and are being presented collectively from the research database.

Document Analysis

We will begin by reviewing some of the key business, cultural, and design strategies employed in the creation of these new workplaces informed by the interviews, and a review of design briefs, corporate communications, press and media releases.

Business and Cultural Themes/Drivers:

The following business and cultural strategies were used to guide the design of these new green workplaces (CS1, 2, 3).

- Reflect a commitment to innovation and sustainability.
- Align work environment with business strategy and brand.
- Provide staff amenities that maximize health and well-being.
- Enhance staff satisfaction and reduce stress.
- Foster collaboration and teamwork.
- Promote casual encounters and informal interactions.
- Encourage movement, flexibility and freedom of choice.
- Provide smart technologies/mobile tools to support flexible work.
- Empower staff to choose where and how they need to work.
- Increase employee engagement.
- Improve staff performance and productivity.
- Reduce sick leave and absenteeism.
- Reduce operating and real estate costs.
- Create a culture that attracts and retains staff.

Design Themes/Drivers:

These are some of the key strategies identified by architects and engineers involved in the design of these green workplaces (CS, 2, 3).

- Reduce the environmental (carbon) footprint.
- Deploy energy-efficient solutions throughout.
- Take advantage of daylight and external view.
- Achieve ‘exceptional’ indoor environmental quality (IEQ).
- Optimise natural ventilation with perimeter operable windows.
- Provide effective and efficient lighting and controls.
- Provide some personal control of comfort conditions.
- Enhance acoustic performance with extensive sound isolation solutions.
- Specify sustainable materials, furnishings, fixtures, and finishes.
- Reinforce the culture and brand attributes.
- Create an environment that supports new ways of working.

“We are committed to growing a sustainable business and this starts with making a concerted effort to ensure our own offices respond to the challenges that the world faces such as climate change and resource constraints.”

Visual Analysis

A typical floor plan from each of the case studies will be examined to capture the not-so-subtle evolution of the ‘open plan’ concept across our research horizon (2009–2014).

If we ignore the building core elements (elevators, fire stairs, mechanical/electrical rooms, toilets, janitor

closets, and so on) we see that nearly 80% of the ‘lettable’ floor area is comprised of high-density, standardized workstations in an open plan environment. Full height, floor-to-ceiling partitions are used sparingly to enclose private conferencing, meeting and training rooms for acoustical privacy. The following interior photographs give you a sense of the openness.



Fig. 9: Typical Floor Plan – Case Study 1 (2009).



Fig. 12: Office Interior, CS1.



Fig. 10: Typical Floor Plan – Case Study 2 (2012).



Fig. 13: Office Interior, CS2.

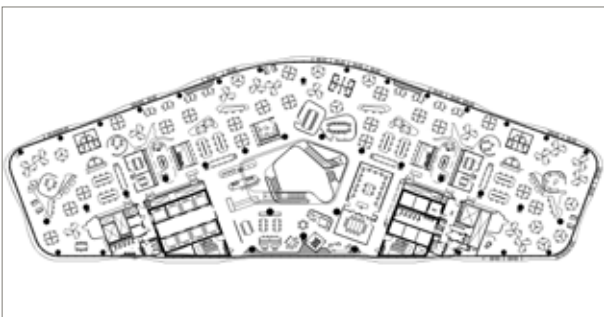


Fig. 11: Typical Floor Plan – Case Study 3 (2014).



Fig. 14: Office Interior, CS3

Below is a listing of the major physical changes observed and identified from the examination of the floor plans.

- Fewer enclosed spaces and floor-to-ceiling partitions.
- Mass-standardization of all workstations, one size fits all (CS1,2).
- Lowered height of all vertical work panels to create more openness visually across the floorplate – see fig. 12,13,14.
- Reductions in the amount of dedicated floor space per person (CS1,2,3).
- Reductions in the amount of personal work-space (less work surface, bins, shelves, files and storage space (CS1,2).
- Elimination of the enclosed, private office (CS2,3).
- Elimination of the dedicated, personal work-space (CS3).
- introduction of lockers, hot-desking, work-points and neighborhoods, in lieu of allocated workspace (CS1,2,3)
- introduction of internal, open, intercommunicating stairs (CS2,3) – see fig. 16, 17.

can be managed more effectively and economically, resulting in less space but better utilized.

These may be reflective of a larger, more global shift taking place in the nature of work and the changing character of the workplace. These new buildings are seen as ‘agents of change’ and space is perceived as a tool to deliver measurable business results.

Qualitative: Semi-structured interviews

Twelve interviews were held at each of the three case study sites with volunteers representing a broad cross-section of staff in terms of age, gender, tenure and management responsibility. Interviews were audio-recorded, later transcribed, and then migrated into NVivo software for qualitative analysis. The following begins to capture some of the patterns and themes emerging from the interview data.

To express their own personal sense of well-being in their new work-places, individuals often compared their previous work setting to their new work environment. For example:

“The difference between our old office and here?

It’s like chalk and cheese, it really is.”

Individuals used simple affective terms to compare the attributes of the old with the new. The following themes were identified from our collective data:

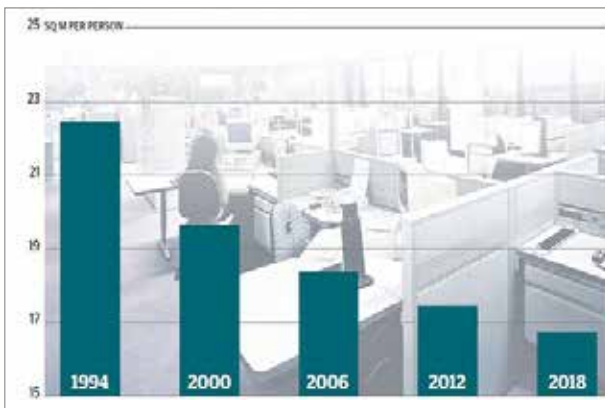


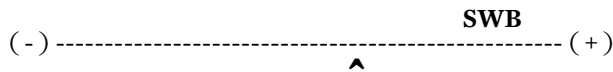
Fig. 15: Allocated Floor Space per Person (sq. m).

A dramatic reshaping of these sustainable work-places is observed across this time frame. Overall, these transformations result in higher building density with the associated reductions in dedicated floor space per person.

There is a growing recognition among many organizations that their workplace is a physical asset that

REFLECTIONS: of the old (-)	PERCEPTIONS: of the new (+)
dull	modern
dirty	clean
tired	comfortable
cramped	flexible
oppressive	light
appalling	airy
ineffective	fresh
cheaply constructed	vibrant
messy	healthy
suffering	impressive
embarrassing	proud

If we place these affective attributes into our circumplex model, we could picture them clustering at each end of the horizontal axis which begins to capture a general valence of subjective well-being in these new green workplaces.



Positive Affects (PA)

The following features were identified by individuals as those from which they derived the most positive affect from their new work environment:

- Healthier, with fresher air and lots of natural lighting.
- More comfortable, with better temperature control seasonally.
- More active, with energy (buzz), vitality, and healthy amenities.
- More green, with recycling, green walls, and interior plant-scaping.
- More open, with daylighting and panoramic views.
- More flexible, with the ability to work in different settings.
- More mobile, but only if the right technology and tools are provided.
- More collaborative, with a nice mix of team and small group spaces.
- More egalitarian, where everyone is treated the same.
- More informal, with places for casual interactions.
- More meeting spaces, with variety of room types, sizes, and technical support.
- More paperless, with less physical storage and better e-archives.

If success is measured by positive affect, then these organizations are reaping some significant rewards for their commitment to creating healthier and more sustainable workplaces. This from a senior manager (CS2):

“If you are feeling good and you like your space then that’s likely to have the greatest correlation to productivity.”

The positive affects are not only related to the employee’s work environment, but also the broader dissemination of the ethos of the organization to the wider community. The workplace communicates this in three ways: by the image it presents to the public; the message it conveys to clients; and the identity that staff attribute to it. A senior executive (CS2) described it this way:

“I think the initial impression when you walk into reception on level 8, that this is a forward-thinking company, a company that has its eye on the future, and that is reflected through the design of the building.”

Thus, the ethos (or brand) of an organization is reflected in the design of its workplace.

New Ways of Working

The evidence suggests that we are witnessing a period of dramatic change in the physical layout and design of these new green workplaces. New tools, technologies, and new ways of working are radically transforming the workplace. Office work is increasingly mobile and being done in wide variety of physical settings obscuring the line between work and home.

Open Plan Work Environments

The open plan office has emerged as the stereotypical place of work for the post-industrial age with over 70% of workers occupying some form of open plan office at the turn of the century (Hodgkinson & Ford, 2011). The open plan office has become the dominant choice of workplace strategies allowing greater numbers of employees to be accommodated (Becker, 2004).

Open plan work environments are not only seen to be efficient, spatially and environmentally, they are also seen to offer opportunities for greater social

interaction and collaboration in the workplace. In particular, communal stairs have become central design features of these new ‘enriched’ work environments.

The open, intercommunicating stairs were seen to be one of the most positive building features mentioned by many of the interviewees (CS2, CS3). These stairs create a more visible connection between floors giving people the opportunity to move more freely through the building without using the lifts or the fire stairs. It opens up numerous opportunities for encounters and interaction.

Nevertheless, the open, ‘social’ environment of these new higher density office environments have created the potential for more noise, distractions, and interruptions (DeMarco & Lister, 1987). While some people really like the ‘buzz’ of an active, open, noisy workplace, for most people, it is a constant source of irritation and a disruption of their work, flow, and well-being. Many staff recounted adaptations they

made to function more effectively in their new open plan work environment. Oddly enough, it was the younger staff who expressed their frustrations most adamantly.

“The biggest impact on me personally with the open plan environment, is that I find it very difficult to concentrate on a piece of work for any length of time. I can be easily distracted. So, it’s a balance between quiet, productive work in a very active, open and collaborative environment.”

Another statement from a young new employee (CS1):

“You have to get used to an open environment. It’s an attitude one has to acquire – being able to shut things out.”

And, while people need many types of spaces and places available to them for work, those set aside for quiet, concentrated and hence, more productive work may be the most important of all (Cain, 2012). Studies have shown that organizations can improve staff productivity (Leaman & Bordass, 2005) and enhance well-being by designing quieter office environments (Bloom et al., 2011).

The short history of the open plan office (Saval, 2014), reveals an industry built around ‘standardization’. In our observations of two of the open plan environments (CS1, CS2), we saw how this has created a workplace filled with workstations of the same basic size and configuration.



Fig. 16: Intercommunicating Stair, CS3.



Fig. 17: Intercommunicating Stair, CS2.

This serves two primary functions:

- **Flexibility** – the ability to freely move people and teams around
- **Equality** – one size fits all, everyone is treated the same

This egalitarian philosophy revealed itself in the following quote from a business manager (CS1):

“The space is for the most part pretty flexible. All the workstations are about the same size so it’s easier to move people around internally.”

Nevertheless, ‘perceived’ status endures as determined by a person’s physical location in an open plan work environment. For example, those nearest the windows (and in control of a bank of shades/blinds) are referred to as the ‘window people’. Or, those staking out executive claims over an open triangulated corner of a floorplate are referred to as the ‘corner people’. The physical trappings of status may have vanished, but the spatial ones have not.

Activity-Based Work (ABW)

From these initial case studies, we are beginning to discern a theme best characterized by Dale and Burrell (2008) as the ‘disappearing workplace’. The stasis of having an office, a workstation, or even a permanent desk is being swept away by many organizations (Dale & Burrell, 2008). Workers are expected to be mobile, to work in multiple physical settings including the home (Felstead, Jewson, & Waters, 2005).

Work is also occurring in ‘non-places’ such as the train, plane, car, or the café (Auge, 1995). Our final case study takes this novel approach to work mobility to a whole other level.

Case Study 3 has embraced the activity-based work concept and has radically restructured the way work is being accomplished across the organization. In the new ABW workplace, staff are provided a locker (for personal belongings) and assigned to a floor and a neighborhood where they are, for the most part, free to move around and ‘follow their work’. A variety of work spaces (referred to as ‘workpoints’) are provided in lieu of a dedicated workspace.

Six months in, people are responding positively to the change. The following figures shows positive responses to five variables by employees across all seven levels of the new building from a post-move survey completed in April 2015 (822 responses, 48% of staff).

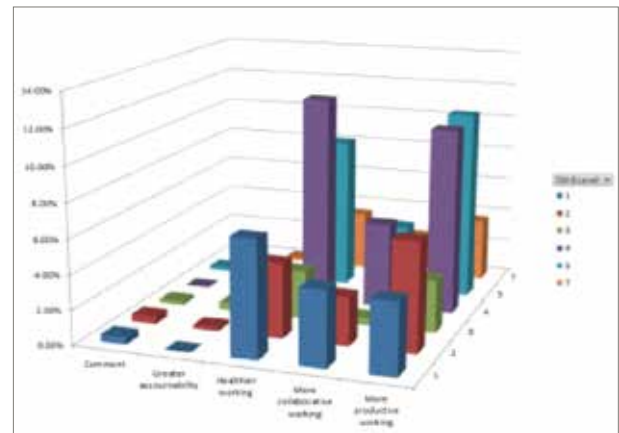


Fig. 18: Positive Post-Move Responses – To Healthier, More Collaborative, and More Productive Working.

Positive Change							
Count of 720 B Level	Column Labels						Grand
Row Labels	1	2	3	4	5	7	Total
Comment	0.43%	0.43%	0.22%	0.00%	0.22%	0.65%	1.94%
Greater accountability	0.00%	0.22%	0.43%	0.86%	0.43%	0.22%	2.16%
Healthier working	6.70%	4.32%	2.81%	12.10%	8.86%	3.46%	38.23%
More collaborative working	4.32%	2.81%	0.43%	4.97%	3.89%	2.38%	18.79%
More productive working	4.10%	6.26%	3.02%	10.80%	11.02%	3.67%	38.88%
Grand Total	15.55%	14.04%	6.91%	28.73%	24.41%	#####	100.00%

Fig. 19: Positive Change Data by Floor Level

Many are thriving:

“I mean the ability to choose where you want to work is so empowering and liberating.”

“People have said that they would never go back to the old way of working where they were stuck at one desk and couldn’t move around.”

A few are not:

“Some people keep going back to the same desk every day. They want that bit of familiarity. They aren’t adapting very well.”

“So we say, ‘it’s OK mate.’”

“I have some mixed feelings about whether I’m happier – I think it’s the space. So everyone is saying, where is my workspace?”

And, from these early post move surveys two interesting issues have surfaced:

The first being the issue of ‘camping’ whereby staff leave personal work items at a ‘workpoint’ as a way to place a ‘hold’ on it. Camping is defined in the organization as ‘not following your work’. With neighborhood densities targeted at 80 percent (available workpoints occupied), this practice decreases workpoint availability, increases crowding, and creates tension amongst staff. Camping also seriously hampers spatial flexibility (a key ABW variable) and leaves employees hunting for a limited number of available workpoints in or around their neighborhoods or floors.

The other issue, with important implications for today’s team-based business cultures, has to do with people’s connection to their team and to their team leader. In both instances, staff are feeling less connected in the new ABW work environment, at least initially. As one senior manager said, “we

need to get our heads around teamwork in non-allocated workspace”.

ABW represents a clear break with the past and a paradigmatic shift in the reciprocal relationship that used to exist between people and their places of work. Employees are now responsible for temporarily seizing parts of a fleeting and fluid workspace, but are also expected to work more effectively.

Further, employees need to be findable and locatable. One of the more interesting technologies designed to support this new ABW work environment is the Serraview system. Harkening back to Bentham’s panopticon, this system allows one to physically locate, in real-time, any employee, anywhere across the workplace. One staff member referred to it as, “stalk and talk”.

**Quantitative:
BUS pre and post-move data**

At Case Study 3, we utilized the ‘online’ BUS Occupant Survey³ administered both pre and post occupancy and were able to explore 58 different study variables related to people’s perceptions of their existing and new work setting.

This brief summary and analysis of pre and post-move data focuses on only two study variables namely: perceived health and, perceived productivity.

These two self-reported measures of well-being give us a sense of staff perceptions just before they moved from their existing workplace and soon after they relocated to their new, and dramatically different, activity-based work setting.

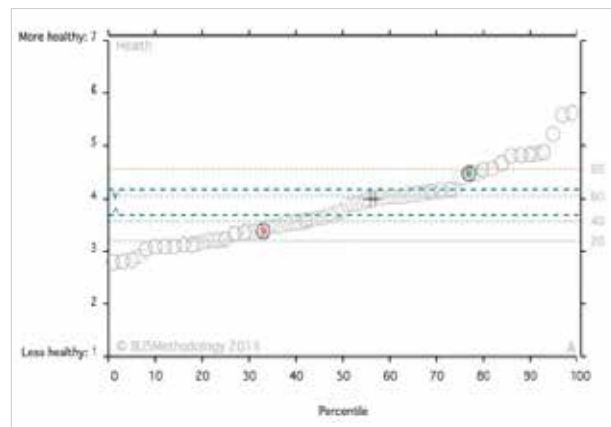


Fig. 20: Perceived Health pre (left, red) and post* (green, right).

* Post-move data is drawn from a small representative sample of staff

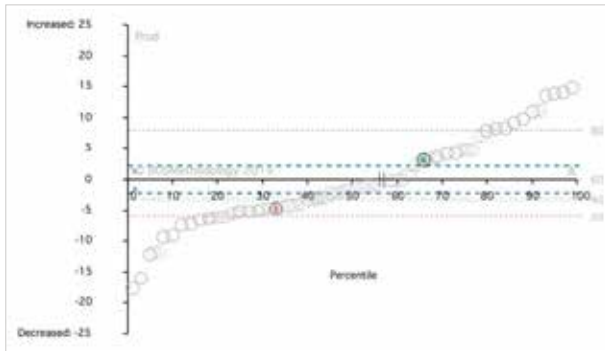


Fig. 21: Perceived Productivity pre (left, red), and post* (green, right).

* Post-move data is drawn from a small representative sample of staff

Again, from these charts, we can see a positive shift occurring in people's perceptions of health and productivity as exhibited three months before and six months after the move to the new workplace.

From these initial analyses of quantitative data, we have seen a spike of positive employee responses to different aspects of the new ABW work setting and a modest, but positive shift in staff perceptions. While it's too early to draw inferences of sustained levels of well-being, it is worth noting that early success and positive affects can help fine-tune the ABW work environment,

Conclusions

This paper has explored the relationship between the transforming work environment and perceived well-being of occupants. The three case studies illustrated here are representative of global shifts towards more dynamic, flexible and 'activity-based' work environments. These 'enriched' environments engage both hedonic states of pleasure and eudaimonic assessments of meaningfulness. Descriptors of positive affect include notions of perceived comfort, vitality and a more 'relaxed' work environment combined with recognition of the communal, egalitarian and flexible workplace afforded by such environments, as well as a sense of pride in the 'green' business identity that they promote.

Preliminary pre and post occupancy data from the third case study supports the position that such enriched environments enhance occupant well-being. However, given the relatively recent occupation of the new building and the tendency for data to be skewed towards positive outcomes in such studies, these results cannot be taken as definitive proof of enhanced wellbeing. It is evident from the qualita-

tive study that some individuals more readily adapt and thrive in these new workplaces, while others seek more stable and calm environments. Strategies such as 'camping' are employed as a strategy to secure more stable or desirable positions within the fluid workspace, while residual spatial hierarchies endure in the occupation of the privileged 'edge spaces'.

Ultimately, these buildings will be judged by how well they sustain the well-being of their occupants over time. We know all too well the human costs of working in negative, pathogenic environments, or so-called, 'sick' buildings. Yet, very little is currently known about the positive affects associated with working in these new green, salutogenic workplaces, or 'well' buildings. This research is an attempt to remedy that. The results suggest that our evaluation of how the physical features of sustainable workplaces affect the psychological well-being of occupants is both timely and within reach. A neural basis for design could lead to a *regenerative* architecture with sustainability and well-being an integral part. *Buildings that you can't get ill in, but in fact, make you feel better for being in them*⁴. □

References

- Auge, Marc (translated by John Howe). (1995). *non-places: introduction to an anthropology of supermodernity*. London: Verso.
- Becker, Franklin. (2004). *Offices at Work: Uncommon Workspace Strategies that Add Value and Improve Performance*. San Francisco, CA: Jossey-Bass.
- Berridge, K., & Kringelbach, M K. (2010). The Neuroscience of Happiness and Pleasure. *Social Research*, 77 (2).
- Bitner, Mary Jo (1992). Servicescapes: the impact of the physical environment on customers and employees. *Journal of Marketing*, 56, 57–71.
- Bloom, M., Cheng, Heerwagon, J., Juba, D., Kelly, K., & Powell, K. (2011). *Sound Matters: how to achieve acoustic comfort in the contemporary office*. Washington, D. C.: GSA Public Building Services.
- Cain, Susan. (2012). *Quiet: the power of introverts in a world that can't stop talking*. London: Penguin Books.
- Dale, K., & Burrell, G. (2008). *The space of organization and the organization of space: Power, Identity & Materiality at Work*. New York: McMillan.
- DeMarco, T., & Lister, T. (1987). *Peopeware: productive projects and teams*. New York: Dorset House.
- Diener, E., Biswas-Diener, R., & Tamir, M. (2004). The Psychology of Subjective Well-Being. *Daedalus*, 133(2), 18...25.

Felstead, A., Jewson, N., & Waters, S. (2005). The shifting locations of work: new statistical evidence on the spaces and places of employment. *Work, Employment & Society*, 9(2), 415–431.

Hodgkinson, G. P., & Ford, K. J. (Eds.). (2011). *The Physical Environment of the Office: Contemporary and Emerging Issues* (Vol. 26): John Wiley & Sons.

Leaman, A., & Bordass, W. (2005). *Productivity in Buildings: the killer variables*. UK: The Usable Buildings Trust.

Posner, J., Russell, J. A., & Peterson, B. S. (2005). The circumplex model of affect: an integrative approach to affective neuroscience, cognitive development, and psychopathology. *Journal of Developmental Psychopathology*, 17(3), 715–734.

Russell, J. A. (1980). A Circumplex Model of Affect. *Journal of personality and social psychology*, 39(6), 1161–1178.

Saval, Nikil. (2014). *Cubed: a secret history of the workplace*. New York: Doubleday.

Vartanian, O., Navarrete, G., Chatterjee, A., Fich, L. B., Gonzalez-Mora, J. L., Leder, H., ... Skov, M. (2015). Architectural design and the brain: effects of ceiling height and perceived enclosure on beauty judgements and approach-avoidance decisions. *Journal of Environmental Psychology*, 41, 10–18.

Vartanian, O., Navarrete, G., Chatterjee, A., Fich, L. B., Leder, H., Modrono, C., ... Skov, M. (2013). Impact of contour on aesthetic judgments and approach-avoidance decisions in architecture. *Proceedings of the National Academy of Sciences USA*, 110((Suppl.2)), 10466–10453.

von Praag, H., Kempermann, G., & Gage, F. H. (2000). Neural Consequences of Environmental Enrichment. *Nature Reviews | Neuroscience*, Volume 1, 191–198.



Acknowledgements

1. This author would like to extend his sincere appreciation to the University of Tasmania, the Faculty of Science, Engineering and Technology, and the School of Architecture and Design, for their generous support of this research. And many thanks to my co-authors and supervisory team for their patience and perseverance throughout.
2. I must also express my deep gratitude to the three case study companies who welcomed me into their progressive organizations during the course of this study.
3. A special thanks to Adrian Leaman of Building Use Studies and the Usable Buildings Trust (www.usablebuildings.co.uk) for support with the survey analysis.
4. Jeffrey Robinson, Sustainability Leader, Aurecon.

Credits

- Floor plans, exterior renderings, interior photographs, charts and tables were provided by the case study companies and are used with permission in this research.
- BUS Methodology Survey graphics, charts, tables courtesy www.busmethodology.org.uk © BUS-Methodology 2015. All rights reserved.

Sources

Figure 1

Google Switzerland GmbH – Combined Photography of Building 100 & 110 (Picasa).

Figure 2

PET Scans – Office of Biological and Environmental Research (BER), Medical Sciences Division, US Dept. Of Energy (DOE).

Figure 3

Paley Park, NYC – Creative Commons, Flickr photograph by Dave M Barb.

Figure 7

Aerial Photo, The Docklands, Melbourne – photo by Dianna Snapes, used with permission.

Figure 15

Allocated Space per Person – Research and Forecast Report, Second Half 2014, CBD Office, Colliers International.

Authors



David Techau is a PhD candidate in the School of Architecture & Design at the University of Tasmania in Australia. He is a licensed architect in the United States and a past member of the American Institute of Architects. He holds a Bachelor of Architecture from Arizona State University, and a Master of Science in Human-Environment Relations from Cornell University in New York. His current research into subjective well-being beckons to a more salutogenic and sustainable future for our places of work.



Ceridwen Owen is Acting Head of the School of Architecture & Design at the University of Tasmania. Her research focuses on inclusive design, with a particular interest in design and Autism Spectrum Disorder (ASD). She employs visual-based research methods to explore experiential aspects of place, including photovoice and alternative mapping practices. Ceridwen is also a registered practising architect in Tasmania and a partner with Core Collective Architects.



Douglas Paton is Professor of Psychology at Charles Darwin University (Australia), a Senior Research Fellow at the Bandung Resilience Institute (Indonesia), and Technical Advisor on Risk Communication to the World Health Organization. He is an environmental psychologist whose research focuses on a) identifying how natural and built environmental factors affect subjective well-being and b) developing and testing all-hazards (seismic, volcanic, tsunami, bushfire, flooding, and health/pandemic hazards), cross-cultural (USA, Australia, New Zealand, Japan, Indonesia, Taiwan and Portugal) theories of resilience and adaptive capacity and capacity building in communities and organizations. Douglas has published 20 books and some 170 peer-reviewed papers. He is Editor of the International Journal of Mass Emergencies and Disasters and sits on the Editorial Boards of Disaster Communication, Disasters, the International Journal of Disaster Risk Reduction, and the Journal of Psychology.



Roger Fay is an Emeritus Professor and former Head of the School of Architecture & Design and Associate Dean (International) at the University of Tasmania. His teaching was in the areas of design, building technology and the relationship between them. Roger's research career focussed on design for sustainability with a specialisation in the life cycle energy and carbon emissions of residential and commercial buildings. However, in recent years the focus has shifted to include design for people with dementia. Roger has found much in common between design for sustainability and design for dementia.

Landscape Therapeutics and the Design of Salutogenic Hospitals: Recent research

Shan Jiang and Stephen Verderber

Introduction

Due to their size and complexity, urban medical centers tend to be once removed from their immediate surroundings, functioning as ‘islands’ amid a surrounding dense sea of urbanity. This condition can preclude genuine connectivity with green spaces that could otherwise aid, in a therapeutic sense, in healing patients and improving the day-to-day experience of families and staff. The presence of green space holds the power to improve occupants’ morale, attitude, and overall disposition. Too often, hospital exteriors appear fortress-like, uninviting. This occurs both by design and by default. It can result from ineffective or insensitive campus master planning resulting from successive waves of expansion projects occurring over a period of decades. These capital improvement initiatives consume valuable former open green spaces, including gardens, lawns, open vistas, and interesting views. In the most unfortunate cases, successive expansions result in windows and views that overlook nearby walls, and parking decks filled with autos. Such conditions are both counterintuitive and countertherapeutic to the ideals of a physical, salutogenic healing environment that would otherwise aim to celebrate and promote the presence of nature and its therapeutic benefits. Such conditions are tantamount to unnecessary physical and cognitive barriers, and as such, can be a needless source of stress for the building occupant.

A paradigmatic shift is underway in the hospital campus planning and landscape architecture discourse. This shift seeks to reject excessive urban hospital densification, just as much as excessive suburban sprawl is to be eschewed, as both conditions deny the therapeutic affordances of nature and landscape. The re-embrace of landscape and nature as a contributor to place and to ‘healing places’ and as therefore being centrally important to the healing experience is underway. This, in certain respects, reprises attributes expressed in the ancient Greek Askleion. (Figure 1 and Figure 2). Much can be learned from the

“In this way, a building becomes quite literally capable of breathing – by achieving direct connectivity with the landscape.”

reappraisal of such precursors in terms of their salutogenic properties (17). Hospitals are only now beginning to be, genuinely, consciously and carefully composed to be in internal and external harmony with environmental sustainability precepts and with the value of engagement with nature. However, research on this topic dates from the 1970s, including the work of Collins [1], Detweiler, et al. [2], Francis and Cooper-Marcus [3], Kaplan and Kaplan [4], Kaplan [5], Kaplan [6], Kuo et al. [7], Olds [8], Pati et al. [9], Pretty [10], Raanaas et al. [11], Stigsdotter [12], Grahn and Stigsdotter [13], Ulrich [14], Verderber [15], and Verderber and Reuman [16]. In the field of environmental psychology, work on attention-restoration theory developed by Kaplan and Kaplan has garnered especially widespread attention, and is relevant to this evolving discourse [4].

The term *theraserialization* has been created to describe a hybrid assemblage of the terms ‘therapeutic’ and ‘serialize’ [17]. This concept provides a promising ‘best practices’ alternative to the current status quo in hospital architecture and campus planning. It is defined as a continuum of indoor to outdoor space that is consciously designed in support of biophilic environmental design principles [18, 19]. It consists of creating spaces that are serialized in function and



Fig. 1: The Temple of Asclepius at Epidauros, 5th century BC,

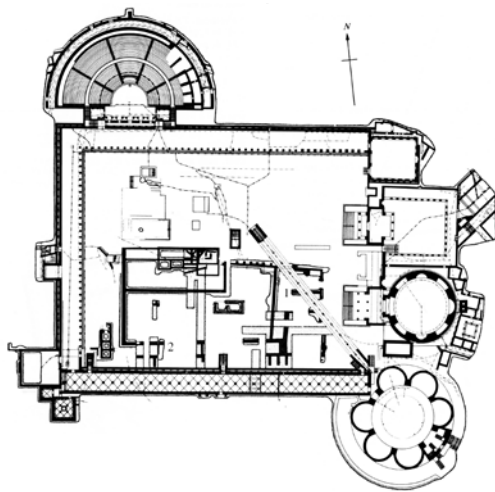


Fig. 2: Pergamon, plan of Asclepiad and sanctuary complex at Epidauros, 5th century BC.

in their affordances — by means of layering, collage, superimposition and relative transparency.

Theraserialization denotes the existence of sequenced spaces from public areas such as parking and main entrance approaches, to the interior main arrival lobby, to corridors throughout the entire facility that open up and into corridors, gardens, and which afford views through to, and outward from, corridors, to semi-private spaces such as dayrooms and terraces, landscaped roof terraces, and ultimately to the inpatient room — facilitating the patient’s direct experience with the outdoors — views, daylight, sounds. Theraserialization emphasizes “anchor” functions equally with the spaces in-between, vis-à-vis illusion, immersion, light/dark contrasts, inter-

esting changes in path directionality, volume, and shifts from transparency to opaqueness. Ideally, it manifests as a continuum, graduated, as opposed to being abrupt, or disjointed. It can be expressed vertically, as in the soaring atrium lobby of the Lurie Children’s Hospital winter garden in Chicago (2012), or horizontally, as in terraces providing impressive views of a nearby mountain range such as at the Boulder Foothills Community Hospital, in Boulder, Colorado (2003) [17]. The meditation garden at the Banner Estrella Medical Center, in Phoenix (2005) comes quite close to the epitomizing this concept. The walls of an interior meditation space are moveable, at one moment closed and a few moments later able to peel away. This dematerialized open-air condition is at once biophilic, fluid, and connected to indigenous vernacular traditions, i.e. the use of natural stone, and incorporation of local fauna. The barrier between ‘inside’ and ‘outside’ dissolves. In this way, a building becomes quite literally capable of breathing — by achieving direct connectivity with the landscape [17].

Transparency, for its part, is closely related to theraserialization and edge-dematerialization of a hospital’s physical envelope. However, a ‘transparent condition’ alone does not necessarily equate with a hospital’s theraserialized physical envelope. In other words, full height windows that connect a clinic’s waiting room with the outdoors cannot succeed in this regard if waiting room occupants must directly look out onto the front bumpers of autos parked outside a mere few feet away. By contrast, if the windows in this same room overlook a garden, or pond, for example, the visual effect can be perceived as restorative, i.e. soothing, and therefore far more preferable.

Landscape Therapeutics: Design Considerations for a Salutogenic Hospital

Twelve design considerations are presented below. Each design consideration is grounded in the research design literature, and each is fundamentally inspired by Christopher Alexander’s classic book, *A Pattern Language: Towns, Buildings, Construction* (see Note 1) [20]. For each design consideration, one or more recent evidence-based design case studies are cited [21]. Col-

lectively, these design considerations are applicable to urban, suburban, and rural hospital environments (Note 1). Particularly closely related evidence-based research precedents, in support of this set of considerations, are also reported. (Table 1). Here, key published, peer reviewed research studies are listed and assigned a weighted assessment of their relevance in relation to each individual design consideration one through twelve. This is followed by the design considerations themselves. (Figures 3a through 14b).

Design Considerations		Research Precursors														
		Cooper-Marcus, C. & Sachs, N. A. (2013) ²¹	Dijkstra, K. et al. (2006) ²²	Edwards, L., and Torcellini, P. A. (2002) ²³	Kaplan, R. et al. (1998) ²⁴	Pasha, S. (2010) ²⁵	Pati, et al. (2008) ⁹	Smith, J. (2007) ²⁶	Ulrich, R. S. (1984) ¹⁴	Ulrich, R. S. et al. (1991) ²⁷	Ulrich, R.S. (1999) ¹⁹	Ulrich, R. Zimring, C. et al. (2004) ²⁸	Velarde, M. D. et al. (2007) ²⁹	Verderber, S. (1986) ¹⁵	Verderber, S. (2010) ¹⁷	Zaden, R. S. et al. (2013) ³⁰
1.	Hierarchy of Landscape Realms	●	○	○		○	◐	◐			○	○	○		◐	●
2.	Courtyards that breathe	●	○		●	○	◐	◐	◐	○	●	●	●	○	●	◐
3.	Vertical Gardens and Cutouts	○		○	◐		○	○				○		●		
4.	Positive Outdoor Spaces	●	○		●	◐		◐	○	◐	●	●	●	◐	●	●
5.	Micro-Landscapes Narrow Wings	◐	●	●			○	○			○		○	○	●	○
6.	Cascading Roof Terraces	●			◐		○	○	○			○	○		●	○
7.	Transparent Arteries	○		○		●		○	○		○	○	◐		○	
8.	Landscaped Arrival Zones	●			○	●	○			○		○			●	
9.	Dematerialized Edges	○		○	◐	◐	○		○			○	○		●	◐
10.	Atrium Gardens and Lightwells	●	●		◐	○		○		○	○				●	○
11.	Sequestered Gardens	○	○				○							●		●
12.	Therapeutic Viewing Places	●	●		●		○	●	●	●		●	●	●	●	●

Table 1. Relationship between Landscape Therapeutics Research and Design Considerations 1–12

Relationship: ● Primary ◐ Secondary ○ Tertiary

Hierarchy of Landscape Realms

Landscape and nature content can be most effective when experienced as a hierarchy of green spaces traversing public, semi-public, and semi-private spaces. The three primary user constituencies of a hospital – staff, patients, and patients' families – can benefit from this strategy. At the Miami Valley Hospital in Dayton, Ohio, adjacent to the recently opened Heart and Orthopedic Center, the campus master plan created by NBBJ (Columbus Office) increases the amount of exterior landscaped space by 54%, resulting in a hierarchical series of interwoven spaces. (Figures 3a and 3b). Campus buildings are arranged around a central landscaped core, and a 'garden spine' functions as a link to a network of exterior landscaped spaces of varying sizes, shapes, heights, and use-affordances [32].

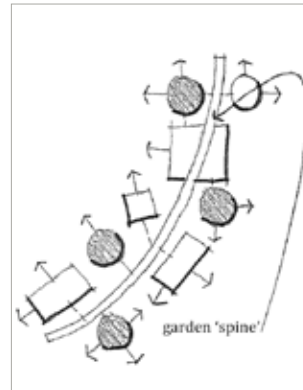


Fig. 3a: Hierarchy of Realms.



Fig 3b: Miami Valley Hospital, Dayton, OH, USA/by NBBJ.

Courtyards that Breathe

Large, otherwise monolithic hospital envelopes can be softened through the creation of vertical and horizontal cutouts and voids, devices that allow the building envelope to be opened up, and daylight to penetrate interiors from the lowest level to the uppermost levels. 'Breathing' also functions as a key wayfinding aid to building occupants – especially when bisected by circulation. Create hierarchical cutouts, voids, and slices, positioned at precise intervals – some completely internalized within the envelope, even from subterranean levels. At Rehab Basel, in Switzerland, by Herzog and de Meuron, the rehabilitation hospital's building envelope features nine 'breathing courtyards' within a large box, resulting in a significant percentage of exterior/outdoor adjoining wall surface area throughout the hospital [17]. Dome-like skylights above every patient bed are a source of additional daylight. (Figures 4a and 4b).

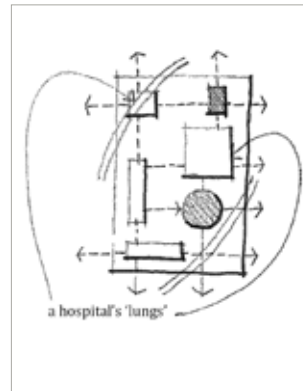


Fig. 4a: Courtyard Network.



Fig. 4b: Center for Spinal Cord and Brain Injuries, Basel, Switzerland/ by Herzog and de Meuron.

Vertical Gardens and Cutouts

In the previous pattern the focus was reductive – carving out volumes to open up the building envelope. Here the emphasis is on vertical cutouts, slices, and perforations, operations involving articulated exterior elevations and building sections. In the case of mid- and high-rise healthcare facilities with narrow footprints on dense sites, this process can yield a variety of openings and indentations in composition and massing, yielding more interesting views, and heightened interior-to-exterior connectivity. Oblique and unusual vistas and views can be maximized in this manner. A vertical garden on the side of a cutout or perforation of this type is a bit reminiscent of a piece of Swiss cheese. In 2012, the firm 3LHD won an international design competition for a medical center in Firule, in Split, Croatia. This polytechnic medical institute is situated near to the sea, with fresh air and dramatic views while complimenting an existing adjacent hospital campus. Semi-public terraces and hanging gardens are interspersed throughout, mirroring the aforementioned vertical band components. (Figures 5a and 5b).

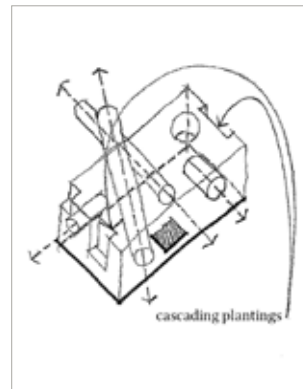


Fig. 5a: Gardens and Cutouts.



Fig. 5b: Polyclinic, in Split, Croatia/ by 3LHD Architects.

Positive Outdoor Spaces

Residual, disconnected outdoor spaces within hospitals are often little preferred by their inhabitants, and are seldom used on a regular basis. By contrast, a hospital that provides a series of inviting, semi-enclosed ‘outdoor rooms’ for their users can add to one’s sense of protection, safety, and the ability to directly experience the outdoors while simultaneously feeling connected to adjoining interior spaces. Include in these spaces landscaping closely calibrated with the width and proportion of wings and the projecting ribbons of adjacent structures. Enhance these spaces by means of trees, hedges, fences, trellised arcades, columned walkways, and porticoes that protect one from unwanted exposure to the natural elements when one elects not to be exposed. As such, this will yield spaces that convey a positive, inviting quality, with spatial definition and therapeutic amenity – particularly when natural daylight and fresh air is in abundance. Dark, claustrophobic conditions represent the antithesis. Positive outdoor gardens and landscaping affordances can become high activity areas, i.e. an exterior terrace adjacent to a main dining room. (Figures 6a and 6b).

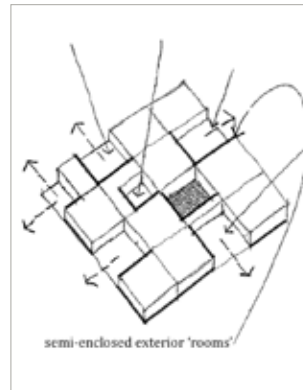


Fig.6a: Outdoor Rooms.



Fig. 6b: Palo Alto Medical Foundation, San Carlos Center, San Carlos, CA, USA/ by NBBJ.

Micro-Landscapes Along Narrow Wings

Twenty-first century buildings for healthcare warrant rethinking from the perspective of natural daylight. It has become desirable for natural ventilation and daylight to penetrate the building envelope, as feasible; regardless of site restrictions such whether the hospital’s site is narrow, amid a dense urban setting, or otherwise. Approach the provision of natural daylight as a positive therapeutic force with the expressive goal to enliven and activate otherwise drab, windowless spaces within the building envelope. Create multiple narrow wings, in footprint, of varying floor (or constant) heights, such as is the case at the Rikshospital in Oslo, Norway (2008) [32]. There, a series of A/B A/B wings project outward from a central building spine. This yields multiple ribbon-like volumes of green landscaped spaces between the projecting wings. At the center of the parti’, four courtyards transmit daylight and fresh air into otherwise entirely windowless spaces. (Figures 7a and 7b).

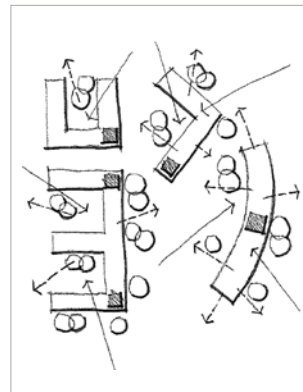


Fig. 7a: Micro-Landscapes.



Fig. 7b: Rikshospitalet, Oslo, Norway/ by Medplan Arkitekter.

Cascading Roof Terraces.

Many memorable and beloved buildings throughout history have featured cascading roofs, with projecting building elements, unfolding into a progression of smaller massings and roof elements, yielding terraces while simultaneously affording respite and the experience of a view of a skyline, a nearby mountain range, and so on. In the case of hospitals that feature well-known roof terraces, the Paimio TB Sanitarium, by Alvar Alto in Finland (1929) is exemplary. It features vertical plantings that hang from the sides with roof terraces on multiple levels, culminating at the uppermost terrace. The International Style megahospital, negated this, as building envelopes ballooned in volume both vertically and horizontally [33]. Cascading roof terraces can be achieved by stepping, yielding shaded places to sit outdoors such as in the winning proposal for Helsingborg hospital’s expansion, in Sweden, by Schmidt Hammer Lassen Architects. (Figures 8a and 8b).

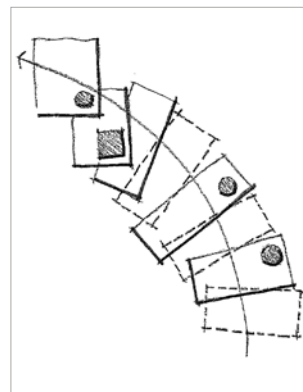


Fig. 8a: Terracing



Fig. 8b: Helsingborg Hospital Winning Proposal, Sweden/by Schmidt Hammer Lassen Architects.

Transparent Arteries

Circulation arteries should be inviting and transparent, affording views onto attractive, landscaped spaces throughout the diverse interior realms within a medical center campus. The term “mover spaces” was used in conjunction with a study of patient and staff perceptions of various public spaces within a hospital [32]. These circulation spaces feature a 24/7 constant hum of people and supplies and function as conduits in support of the ebb and ow of the daily patterns of use within a hospital and its medical center context. Corridors, connecting bridges and walkways, and vertical elements such as glass sheathed elevators and escalators, are essential in the creation of this type of person-landscape interconnectivity. In one recent study it was found that a garden located amid a low-trafficked zone within a hospital had a far lower probability of being discovered. By contrast, gardens located along a highly trafficked zone – public corridors as well as staff circulation – were much more actively used [28]. Incorporate transparency – with landscape and nature as magnets. (Figures 9a and 9b).

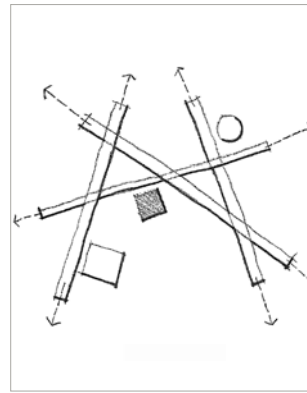


Fig. 9a: Transparency.



Fig. 9b: Meyer Children's Hospital, Florence, Italy/by Anshen + Allen with C.S.P.E.

Landscaped Arrival Zones

Main arrival zones, and increasingly, emergency department entrances, are often abrupt, lacking inviting aesthetic attributes to soften the transition into the somewhat cloistered, protective realm of the hospital. Albeit, it remains critical that the hospital be a safe and protective place, yet without it looking like a fortress. In this regard, strive to use nature and landscaping to avoid disorienting, sudden, or jarring transitions from the outer world to the inner world of the medical center. Single-family dwellings traditionally have front porches, where one can be seen and see others coming and going. This ambiance is reinterpretable throughout the campus, originating perhaps with bright entry portals and by establishing axuality with the use of landscaping. This is achieved at the Fleury Medicina E Saude, in Sao Paulo, Brazil, by Perkins + Will (2011). The entrance sequence features natural daylight, trees, and ground plantings. (Figures 10a and 10b).

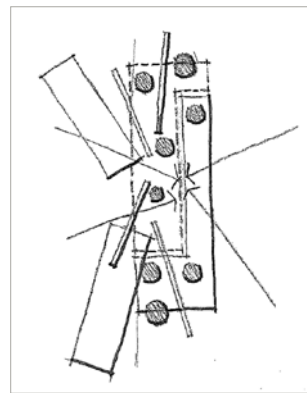


Fig 10a: Landscaped Arrival Zones.



Fig 10b: Fleury Medicina E Saude, Healthcare Ibirapuera Unit, Sao Paulo, Brazil/by Perkins + Will.

Dematerialized Edges

The exteriors and edge conditions of the minimalist International Style hospital were often harsh, inviting, and excessively institutional. Now, exterior facades and edges can be highly porous, gridded, tactile, transparent, layered and textured versus mid to late 20th century brutalist hospital exteriors and their edge conditions. This new transparency and dematerialization allows for far more openness, varied compositional massing, stepped floor levels, user-friendly roofscapes, and deconstructed services that need no longer to be housed within the hospital's 'main chassis.' One should be able to walk, for instance, outdoors from the patient room onto a roof terrace, balcony, or a ground level space [17]. A continuum was created at the Peter and Paula Fasseas Cancer Clinic, at University Medical Center, in Tucson. Its dematerialization yielded a tapestry of light and dark, mix of screened and semi-screened spaces accentuated by indigenous ground plantings. (Figures 11a and 11b).

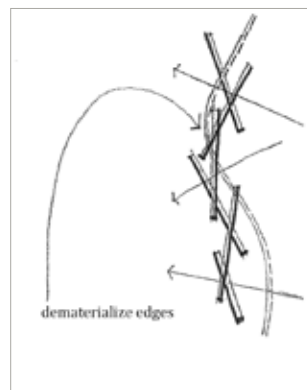


Fig 11a: Dematerialization..



Fig 11b: Peter & Paula Fasseas Cancer Clinic University Medical Center, Tucson, AZ, USA/ by CO Architects..

Atrium Gardens and Lightwells

An atrium is capable of drawing much-needed daylight, natural ventilation, and spatial diversity deep within the building envelope. In extreme climates, sitting or strolling outdoors may not be possible—due to excessive heat and humidity or excessively cold temperatures—whereas an atrium garden or lightwell that is vegetated functions year-round via a skylight or one equipped with an operable roof. Winter gardens in extreme climates, and vertical lightwells, can feature a canopy of trees, ground plantings, seating, and water features, even possibly water walls and ponds [19]. A canvas canopy shields the courtyard at the Sun Health Hospice, in Phoenix, Arizona, by Taliesin Architects (1997) in the hot arid climate of the American Southwest [38]. Another example is the John Muir Medical Center Walnut Creek Campus, by Ratcliff Architects. The Meyer Children’s Hospital, in Florence, Italy, features three conically shaped cutouts and colorful sculptures at ground level, double functioning as wayfinding aids [17], Occupants are invited to look upward towards the sky(lights).

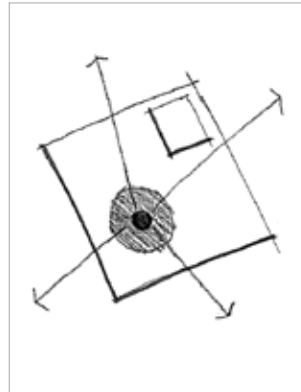


Fig. 12a: Atriums and Lightwells.



Fig. 12b: John Muir Health: John Muir Medical Center Walnut Creek Campus Expansion and Remodel, Walnut Creek, CA, USA/by Ratcliff Architects.

Sequestered Gardens

Courtyard gardens, in otherwise unadorned spaces and corridors in a hospital, are a source of intrigue. They are sought out while not being visible from the street and are often only accessible through relatively narrow passageways. The relationship between a garden and its adjacent spaces is complex and spatially multifaceted. Its placement at midpoint—somewhere between the street and the most inner confines of the hospital—is preferred, fostering building inhabitants’ sense of discovery, while providing restorative amenity. These spaces can lie half-hidden, waiting to be discovered. Cutouts, setbacks and linear slices are in evidence at the Khoo Teck Puat Hospital in Singapore, designed by RMJM (2012). There, a half-hidden garden is adjacent to the main circulation artery. The parti’ is governed by the site’s natural amenities—resulting in a ‘hospital in a garden’. The gardens and water features at the main entrance reoccur throughout the interior, culminating in a series of stepped garden terraces on the patient housing floors.

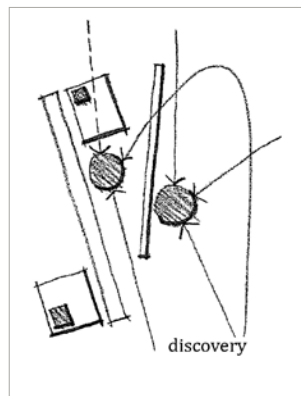


Fig. 13a: Hidden Gardens.



Fig. 13b: Khoo Teck Puat Hospital, Singapore/by RMJM.

Therapeutic Viewing Places

As hospitals successively expand, green spaces, trees, and gardens are too often the first to go. These amenities are prime targets for hospital expansion projects, largely because they have no vocal constituencies to advocate for their preservation. This is precisely that occurred at Michael Reese Hospital, infamously, in the late 1950s and early 60s, in Chicago [33]. In their place, harsh, uninviting new buildings, along parking decks and surface car parks, were constructed. Concomitantly, meaningful views onto these open spaces are lost, as are views outward to the world beyond: an urban skyline, natural shoreline, wooded area—all potentially offer therapeutic benefit as providers of brief respite from the rigors of one’ disease or illness. At the Owensboro Health Regional Hospital, in Owensboro, Kentucky (2012), visitors are able to experience framed views of the surrounding natural landscape [32].

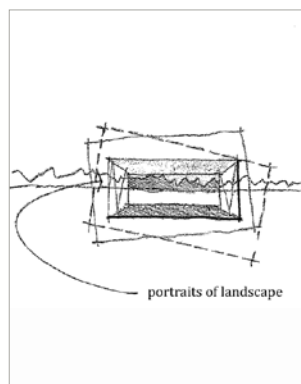


Fig.14a: Framed Views of Nature.

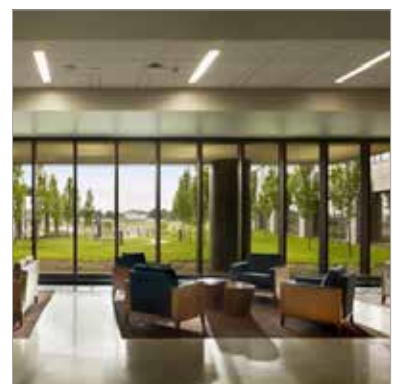


Fig. 14b: Owensboro Health Regional Hospital, Owensboro, KY, USA/by HGA.

Engagement with Nature in Waiting Room Settings: An Empirical Investigation

A recent empirical investigation (2015) explored human engagement with nature in hospital public waiting areas as a function of the impact of the degree of transparency that exists (or does not exist) between interior and exterior realms, vis-à-vis windows and the views they afford of the outdoors, as seen from these spaces. The realm of the hospital environment waiting room was selected because nearly every visitor and patient who seeks treatment at a hospital or allied medical treatment facility experiences this type of space, many returning on a repeated basis over the duration of a period of treatment that may last many months. The waiting area, as a discrete spatial entity, and its associated circulations spaces, i.e. hallways and vestibules, are therefore of fundamental significance to the day-to-day operations of a hospital and its broader medical center context. These spaces are equally fundamental as they often provide an indelible first impression of the overall facility to all newcomers to the hospital. As mentioned earlier, the role of nature had too often been tenuous, at best, in the ever expanding, densely developed International Style urban hospital campuses of the mid-to-late 20th century. In these care settings, the role and importance of person-environment transactions with nature and the outdoors was, too often, minimized to an insignificant stature.

The goal of this investigation was to ascertain whether the role and function of transparency is of importance to the occupants of this type of space, particularly in urban hospital settings. Second, to ascertain whether a greater degree of visual transparency and overall interconnectness between the indoors and outdoors contributes to a more salutogenic hospital environment. Two fundamental assumptions at the outset were: 1. The functional deconstruction of the modernist hospital/medical center has already been underway over the past twenty-five years [2, 17]. A significant level of visual transparency between the interior and exterior realms, as expressed through the aforementioned precept of theraserialization may have a positive therapeutic effect on occupants of waiting rooms, in terms of reducing their overall level of physiological and psychological stress. Functional deconstruction is defined here as the extent that functions of a highly centralized hospital/medical center are redistributed elsewhere, off site, in the community, thereby resulting in a reduced overall hospital/medical center 'footprint' [31, 33].

Due to space limitations, the present discussion does not allow for a detailed description of this investiga-

tion, therefore only a brief summary is provided. The basic research question was to ascertain whether one's degree of exposure to nature in this type of setting significantly impacts respondents' overall mood, perceptions, and environmental assessments of the physical settings being evaluated. Three levels of exposure were assessed: little, moderate, and maximum exposure to nature from within the waiting room setting. As mentioned, the theoretical premise was drawn from attention-restoration theory that postulates that an excessive amount of directed attention can become stressful and that an appropriate level of engagement with nature can be restorative and can help to lessen mental fatigue [24]. It was hypothesized that transparency and nature engagement is preferred versus windowless and minimally windowed hospital waiting areas. As for the research methodology, a laboratory experiment was designed whereby a total of ninety-five university students (N= 48 males; N= 47 females) at Clemson University, between the ages of 18–30, evaluated a series of 21 slides of hospital waiting areas (7 slides depicting no windows; 7 slides depicting limited views to the outdoors; and 7 slides of scenes depicting a high degree of transparency between indoors and outdoors). The set of images presented to respondents were sampled from the literature and were pre-rated by a team of five expert reviewer/judges (academicians and practitioner-specialists in healthcare facility research and design) along a series of rating scales as to their being expressive of a continuum of scenes ranging from windowless to highly windowed, and from no nature content to a high level of exterior nature content. The setting for the experiment was a research laboratory in the School of Nursing at Clemson University. Each respondent's systolic blood pressure was recorded, as was one's heart rate, measured continuously by means of a GE Dinamap device. Mood disturbance assessment was assessed by means of the POMS pre-validated mood assessment instrument, and each slide was also assessed on a five-point likert scale. The three conditions of slide content were referred to as Treatments 1, 2, and 3 (T1, T2, and T3).

Among the findings, it was learned that six slides (of the set of 21) were particularly preferred. (Figure 15). These slides contained views of nature that respondents' found to be particularly engaging, i.e. sampled scenes identified as not being stressful or aesthetically unappealing. Additionally, the mood scores of female subjects were found to be significantly higher across T1, T2, and T3 compared to male subjects for those images depicting a highly transparent view condition of nature. Female subjects' depression and anger scores were found to be significantly lower while viewing this type of scene, implying that transparency and a heightened degree

of visual engagement with nature content may have a rather pronounced effect on female patients. This finding, while rather unexpected, may have major ramifications for facilities geared towards women’s healthcare, and is therefore worthy of further investigation in future studies.

As mentioned, a second major finding was that the top six highest rated scenes depicted highly transparent conditions, with windowless scenes garnering the lowest preference and mood assessment scores. Specifically, these scenes featured floor to ceiling windows and maximized natural views, i.e. ground vegetation and trees, and views looking onto healing gardens, abundant natural daylight, rooms that depicted seating facing onto (versus away from) the window wall, and interiors that feature natural materials including stonework, task ambient lighting, comfortable furnishings, and scenes depicting a fireplace in the waiting room.

The twenty-one scenes evaluated by the respondents were subjected to statistical multivariate factor analysis. This analysis process yielded six ‘factors.’ Three of these (F2, F4 and F5) related especially strongly to and underscored the salience of five of the twelve design considerations. Each factor-analytic index, or ‘dimension’ of similarly rated items, contained between three and images similarly perceived by respondents. These five most closely-related design considerations (DCs) were Transparent Arteries (DC7), Dematerialized Edges (DC9), Atrium Gardens and Lightwells (DC10), Sequestered Gardens (DC11), and Therapeutic Viewing Places (DC12). These relationships were illustrated in Figure 13. These were therefore empirically supported, particularly Therapeutic Viewing Places (DC12). It was found that when all empirical data were collectively assessed, this DC had the strongest potential to reduce respondents’

negative mood, optimize their visual preference and thereby have a positive overall outcome effect in respondents’ stress reduction. Here, scenes of waiting areas that provide full views of nature and have seating that allows and encourages occupants to look directly outside were most preferred and were perceived as least stressful. Specifically, large windows and/or high-window-to-wall ratios were featured, where direct views to exterior landscapes and healing gardens were present (as opposed to brick walls and parking lots), water features were visible, and views overlooking and onto human activity in the everyday milieu. Additionally, sightlines allowed for direct contact/engagement with nature and with natural daylight. Seating in the most highly preferred scenes was clustered along the window wall without negating natural seating arrangement affinities, and comfortable seating was provided.

Directions for future research on this topic include perhaps applying a more pronounced, manipulated stressor-source, a larger respondent sample size, additional emphasis on qualitative methods in data collection, such as behavioral observation and interviews, and compare/contrast methodologies whereby real conditions and the same sampled conditions are assessed in tandem or sequentially in a phased manner with the sampled scenes assessed extemporaneously, followed by an encounter with and assessment of those same actual scenes. In other words, the utilization of a mixed-method, phased research design strategy either in lieu of, or in conjunction with, a laboratory component in future work on this subject can possibly generate more comprehensive insights into person-nature transactions in the hospital environment, not only in waiting areas but in other areas of the hospital environment [32].

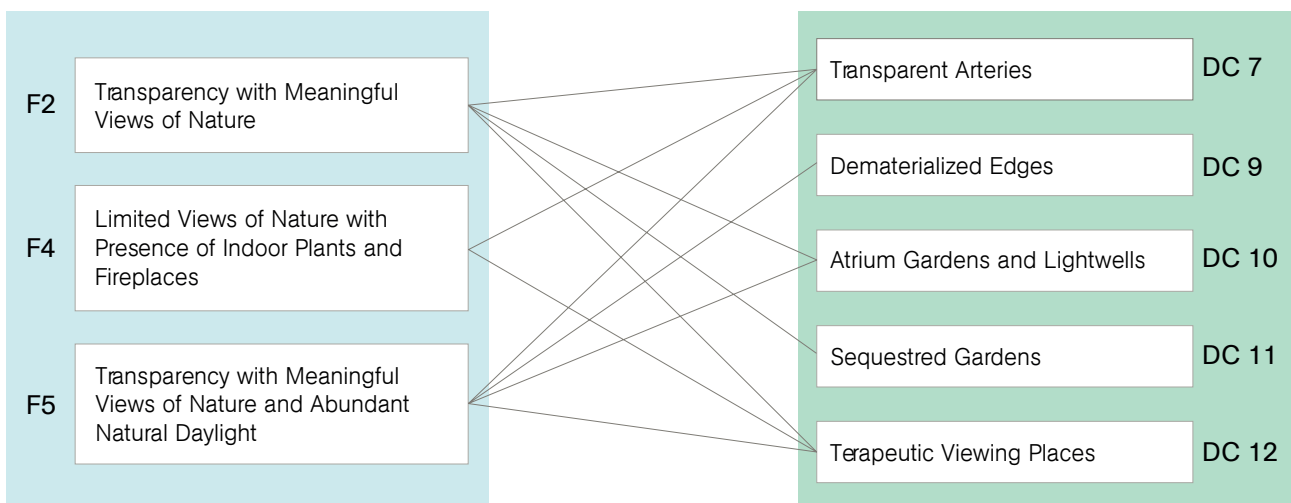


Fig. 13: Empirical Relationship Between Factor Analytic Dimensions and Design Considerations.

Summary and Future Directions

The immense urban megahospitals of the late 20th century were conceived and erected in a manner that too often divorced patients from the immediate and broader natural environment, isolating them from the therapeutic affordances of natural daylight, view, and ventilation, and from direct contact with exterior spaces such as gardens [33]. It has been argued that such conditions were (and are) stressful as they induce a type of sensory understimulation [28]. Moreover, even where a healing garden may be present, it may be closed off to use, thereby creating frustration and becoming counter-salutogenic from a patient-healing standpoint [25, 34]. For the building inhabitant, environmental stressors of this type are avoidable and can be mitigated through sensitive, compassionate planning and design strategies.

In the empirical investigation reported above, for the first time, a theory of relative, serialized transparency was operationalized. The findings provide further fuel to the argument for the articulation of a continuum of landscape-architectural connectivity within healthcare environments. Transparency, as conceptualized by architectural theorists, has been expressed as ‘continuous spatial sequencing’ [35]. This condition, ostensibly, can manifest in the blurring of needless artificial lines of demarcation between the interior and exterior in healing settings and in their associated public support spaces such as corridors and entry vestibules [37].

The research and built case studies literature review conducted a priori, plus the specific findings of the empirical investigation reported above, collectively point to the importance of avoiding the guillotine effect, whereby the exterior walls of the hospital slam down to the ground, taking little cognizance of the potentially powerful effect of nature and landscape as healing modalities. Instead, the surrounding natural ecosystem can be interwoven, inventively, throughout the healing environment of a hospital through thoughtful landscape design and site planning strategies. Strive to create a genuine sense of place while simultaneously achieving internal/external connectivity – as an unbroken continuum – between ‘landscape’ and ‘architecture’. Their mutual exclusivity must be eschewed in favor of a new type of symbiosis.

This innovative approach is achievable at all scales of a healthcare facility, from site planning to the design of an inpatient room and its nature-connectivity quotient. In general, excessive, or worse, wholly needless visual barriers and over-compartmentalization of rooms and room typologies, are among the most blatant enemies of theraserialization. Of course,

“Transparency, as conceptualized by architectural theorists, has been expressed as continuous spatial sequencing”.

the satisfaction of internal functional requirements will out of sheer operational and patient care necessity continue to be of highest priority in any hospital of any size in virtually any site context. Nonetheless, certain longstanding biases, which have been implacably skewed towards highly internalized, minimalist building envelopes, windowless rooms, and poorly windowed spaces, warrant a thorough reappraisal at this time. This is being borne out in recent innovative built hospital case studies (those cited above, as well as in other hospitals driven by these and similar precepts), in the recent research on this subject, and in the numerous ‘legacy’ research investigations carried out over the past three decades [38]. The modernist credo “form follows function” calls for a reinvention—literally turning it inside out – in favor of hospitals that possess ‘lungs’ that allow them to literally and figuratively breathe and boldly extend outward and upward to meaningfully re-connect with nature and with the stress-relieving, therapeutic affordances of landscape [39, 40]. When this transformation fully occurs, landscape architecture for health, as a scholarly discipline, and as a professional endeavor, will have attained unprecedented stature in 21st century hospital architecture. □

Note 1

Christopher Alexander et al (1977) patterns that inspired patterns 1-12 above are include patterns 096, 098, 107, 108, 109, 111, 112, 114, 116, 118, 119, 122, 126, 128, 131, 134, 135, 150, 157, 160, 163, 166, 167, 175, 180, 192, 193. Also see Cooper-Marcus and Sachs’ typology (2012): 01: Extensive Landscapes; 02: Borrowed Landscape; 04: Landscaped Setback; 05: Nature and Fitness Trails; 06: Entry Garden; 07: Backyard Garden; 09: Courtyards; 10: ‘Hole-in-a-Donut Garden;’ 12: Roof Gardens/Hanging Garden; 13: Roof Terrace; 14: Peripheral Garden; 15: Atrium Garden; 16: Viewing Garden.

References

- Collins, BL, *Windows and People: A Literature Survey*. National Bureau of Standards, Washington, DC: US Government Printing Office; 1975.
- Detweiler, MB, Sharma, T, Detweiler, JG, Murphy, PF, Lane, S, Carman, J, and Kim, KY. What is the evidence to support the use of therapeutic gardens for the elderly? *Psychiatry Investigation*, 9:2; 2012.
- Francis, C. and Cooper-Marcus, C. Places people take their problems. *Proceedings of the 22nd Annual Conference of the Environmental Design Research Association*. Oklahoma City: Environmental Design Research Association; 1992.
- Kaplan, R, and Kaplan, S. *The Experience of Nature: A Psychological Perspective*. CUP Archive; 1989.
- Kaplan, R. The role of nature in the context of the workplace. *Landscape and Urban Planning*, 26:1; 1993.
- Kaplan, R. The nature of the view from home psychological benefits. *Environment and Behavior*, 33:4; 2001.
- Kuo, FE, Bacaicoa, M, and Sullivan, WC. Transforming inner-city landscapes: trees, sense of safety, and preference. *Environment and Behavior*, 30:1; 1998.
- Olds, AR. Nature as healer. *Children's Environments Quarterly*, 14:2; 1989.
- Pati, D, Harvey, TE, and Barach, P. Relationships between exterior views and nurse stress: an exploratory examination. *Health Environments Research and Design Journal*, 1:2; 2008.
- Pretty, J. How nature contributes to mental and physical health. *Spirituality and Health International*, 5:2; 2004.
- Raanaas, RK, Evensen, KH, Rich, D, Sjøstrøm, G, and Patil, G. Benefits of indoor plants on attention capacity in an office setting. *Journal of Environmental Psychology*, 31:1; 2011.
- Stigsdotter, UA, and Grahn, P. A Garden at Your Workplace May Reduce Stress. *Design and Health*; 2004. Accessed at <http://www.designandhealth.com/uploaded/documents/publications/papers/Ulrika-Stigsdotter-WCDH-2003.pdf> (31 January 2015).
- Grahn, P, and Stigsdotter, UA. Landscape planning and stress. *Urban Forestry & Urban Greening*, 2:1; 2003.
- Ulrich, RS. View through a window may influence recovery. *Science*, 224:4647; 1984.
- Verderber, S. Dimensions of person-window transactions in the hospital environment. *Environment and Behavior*, 18:6; 1986.
- Verderber, S, and Reuman, D. Windows, views, and health status in hospital therapeutic environments. *Journal of Architectural and Planning Research*, 4:1; 1987.
- Verderber, S. *Innovations in Hospital Architecture*. Taylor & Francis; 2010.
- Ulrich, RS. Biophilia, biophobia, and natural landscapes. *The Biophilia Hypothesis*; 1993.
- Ulrich, RS. Effects of gardens on health outcomes: theory and research. In Cooper-Marcus, C. & Barnes, M. (eds.), *Healing Gardens: Therapeutic Benefits and Design Recommendations*. New York: John Wiley & Sons; 1999.
- Alexander, C, Ishikawa, S, and Silverstein, MA. *Pattern Language: Towns, Buildings, Construction*. Oxford: Cambridge University Press; 1977.
- Cooper-Marcus, C, and Sachs, NA. *Therapeutic Landscapes: An Evidence-based Approach to Designing Healing Gardens and Restorative Outdoor Spaces*. New York: John Wiley & Sons; 2013.
- Dijkstra, K, Pieterse, M, and Pruyn, A. Physical environmental stimuli that turn healthcare facilities into healing environments through psychologically mediated effects: a systematic review. *Journal of Advanced Nursing*, 56:2; 2006.
- Edwards, L, and Torcellini, PA. *A Literature Review of the Effects of Natural Light on Building Occupants*. Golden, CO: National Renewable Energy Laboratory; 2002.
- Kaplan, R, Kaplan, S, and Ryan, R. *With People in Mind: Design and Management of Everyday Nature*. New York: Island Press; 1998.
- Guenther, R, and Vittori, G. *Sustainable Healthcare Architecture*. New York: John Wiley & Sons; 2013.
- Smith, J. *Health and Nature: The Influence of Nature on Design of the Environment of Care*. Concord, CA: The Center for Health Design; 2007.
- Ulrich, RS, Simons, RF, Losito, BD, Fiorito, E, Miles, MA, and Zelson, M. Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11:3; 1991.
- Ulrich, RS, Zimring, C, Quan, X, Joseph, A, and Choudhary, H. *The Role of the Physical Environment in the Hospital of the 21st Century: A Once-in-a-Lifetime Opportunity*. Concord, CA: The Center for Health Design; 2004.
- Velarde, MD, Fry, G, and Tveit, M. Health effects of viewing landscapes: landscape types in environmental psychology. *Urban Forestry & Urban Greening*, 6:4; 2007.
- Zadech, RS, Shepley, MM, Williams, G, and Chung, SS. The impact of windows and daylight on acute-care nurses' physiological, psychological, and behavioral health. *Health Environments Research and Design Journal*, 7:4; 2013.
- Jiang, S. *Encouraging Engagement with Therapeutic Landscapes: Using Transparent Spaces to Optimize Stress Reduction in Urban Health Facilities*. New York: University Dissertations International; 2015.
- Dombroski, MM. Raising the bar at Owensboro Health Regional Hospital. *Healthcare Design*, 12:7; 2013. Accessed at <http://www.healthcaredesignmagazine.com/article/raising-bar-owensboro-health-regional-hospital?page=show> (13 May 2014).

33. Verderber, S, and Fine, DF. *Healthcare Architecture in an Era of Radical Transformation*. New Haven: Yale University Press; 2000.
34. Cooper-Marcus, C. Healing Gardens in Hospitals. *Interdisciplinary Design and Research E-Journal*, 1:11; 2007.
35. Rowe, C, Slutsky, R, and Hoesli, B. *Transparency*. Basil: Birkhauser; 1997.
36. Pasha, S. Accessibility assessment in four hospital gardens in Texas. *Proceedings of the 41st Annual Conference of the Environmental Design Research Association*, Washington, DC; 2010.
37. Pangrazio, J. Planning public spaces for healthcare facilities. *Health Facilities Management*, 46:3; 2013. Accessed at http://www.hfmmagazine.com/display/HFM-news-article.dhtml?dcrPath=/templatedata/HF_Common/NewsArticle/data/HFM/Magazine/2013/Mar/0313HFM_FEA_design (13 May 2014).
38. Berry, LL, Parker, D, Coile, RC, Hamilton, DK, O Neill, DD, and Sadler, BL. The business case for better buildings. *Frontiers of Health Services Management*, 21:3; 2004.
39. Verderber, S, and Refuerzo, BJ. *Innovations in Hospice Architecture*. London: Taylor and Francis; 2006.
40. Ulrich, RS. Visual landscapes and psychological well being. *Landscape Research*, 4:1; 1979.

Authors



Shan Jiang, MLA, Ph.D. is a graduate of the Doctoral Program in Planning, Design, and the Built Environment at Clemson University, and currently Assistant Professor, West Virginia University, in the United States. Her doctoral dissertation addressed the relationship between landscape architecture and the public realm of acute care hospitals and their associated urban medical center contexts. She has published her research in North America and in China.



Stephen Verderber, Arch.D., NCARB is Professor and Associate Dean for Research at the Daniels Faculty of Architecture, Landscape, and Design, and Adjunct Professor, Dalla Lana School of Public Health, University of Toronto, Canada, and founding co-principal of R-2ARCH. He holds a doctoral degree in architecture and environmental psychology from the University of Michigan and has taught at Tulane University and Clemson University in the United States. Dr. Verderber is Distinguished Professor, Association of Collegiate Schools of Architecture (ACSA), and his most recent book is *Innovations in Transportable Healthcare Architecture* (London: Routledge, 2015). He is a founding member of Global University Programs in Healthcare Architecture.

The ‘Salutogenic Hospital’

Inclusive Design for Promotion of Health and Wellness in India

Dr. Ragini N. Mohanty, Prof. Anjali Chandra Kumar, Prof. Richa Shah

Historically, mankind has witnessed disease treatment protocols evolve from medical therapeutics to surgical and invasive procedures and now to the emerging inclusive convergence of disease prevention and health promotion through technology, wellness, art, culture, beauty, and sustainable solutions. Worldwide, illness patterns now range from chronic lifestyle diseases to epidemics of communicable diseases with hotspotting of certain territories due to rapid and uncontrolled globalization and industrialization, leading to unhealthy and behavioral habits.

This has resulted in increased cost of care with the impact so severe that some countries have impoverished and witnessed economic downturn. WHO has defined ‘Health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’. Hence from a health and well-being perspective, it is felt appropriate that architectural planning and environment ambience of a designed structure could be significant contributors in addition to the therapeutics. Hospitalized patients and to some extent their care takers are cut off from the natural environments and remain secluded to the pastel shades and bland lights for most part of their stay. Whilst bodily pain and discomfort is being treated, the mental anxiety and stress is probably not given adequate consideration in the treatment protocols.

Research has revealed that the physical environment of a place has psychological impact on the patient and their care takers, wherein design and ambience is known to stimulate and engage people, both mentally and socially, and support an individual’s sense of coherence. A patient’s hospital stay period and experiences as part of the holistic recovery process could be improved by promoting Salutogenic philosophy to focus on the factors that keep us well, rather than make us unwell. Conceptually salutogenesis is defined by Aaron Antonovsky as the movement towards the ease end of the health (disease) continuum.

Objective

The objective of the researcher is to understand:

- THE CONCEPT OF Salutogenesis on the patient well-being in Indian setting.
- THE AWARENESS ABOUT Salutogenesis as a contributor to customer satisfaction.

Methodology

An empirical study, where secondary research included: white papers, research papers, conceptual understanding of other countries perception about the same has been done.

Results and Conclusion

International research studies by architects and psychologists are suggestive of a relationship between the salutogenesis and early recovery and wellbeing of hospitalized patients as well as reduction in the length of stay of patients in the hospital. However, there are no such studies available from the Indian healthcare sector in terms of applied research. This paper attempts to fulfill this gap by creating awareness about salutogenesis to be an important component contributing to the overall wellness of patients. This can also serve as a differentiator for hospital outcomes and improved customer satisfaction.

Introduction

Worldwide, illness ranges from chronic lifestyle diseases to epidemics of communicable diseases, stress and chronic disability resulting in increased cost of care with the impact so severe that some countries have impoverished and witnessed economic downturn.

Treatment and care methodologies have evolved from traditional to modern medical therapeutics, surgical and advanced micro-invasive procedures and now to the emerging inclusive convergence of comprehensive modalities for disease prevention and health promotion through technology, wellness, art, culture, beauty, and alternative medicine for sustainable outcomes.

To quote WHO's definition of Health 'Health as a state of complete physical, mental and social well being and not merely the absence of disease or infirmity'. Being free from illness confers the ability to realize one's full potential of productivity and sense of well being. Alongside the medical modalities of care environmental factors also contribute to the healing process.

Hospitalization is quite traumatic to both patients and their relatives. Presence of noise of the machines and equipments, auditory cues from other patients in the environment around them, the smell of disinfectants, 24-hr exposure to artificial lights, and crowds with sickness and pain all around and disturbed sleep patterns can leave people feeling helpless and tired. As such patients and relatives do not have control on things once they are turned in at the admissions and to the treating team, decisions are painstaking and dependent on multiple discussions and iterations.

There are tangible experiences of bodily suffering from disease and treatment protocols, disrupted sleep patterns, with the intangible and subjective elements of stress and anxiety affecting their mind and emotions, which are not taken into consideration under the scientific healing protocols during the recuperation phase resulting in diminished satisfaction. International literature has revealed that physical environment of a place has psychological impact on the patient and their relatives, wherein design and ambience is known to impact their sense of coherence, both mentally and socially. The journey to normalcy involves the concerted symphony of medications, adequate rest, eating right, guided care with connectedness to nature, art, music, spiritual wellness, pets, and other forms of simple activities that motivates purposeful engagement.

To quote Florence Nightingale's experience of hospitals "being able to see out of a window, instead of looking at a dead wall", was "quite perceptible in promoting recovery". It is often noticed that if the patients are relaxed their recovery or healing time is reduced. Green outdoor environments (GOE) are reported to have beneficial impact of salutogenesis on patient recovery.

The concept of physical environment having an effect on the healing of patients was first established by Aaron Antonovsky in 1979 and termed as 'salutogenesis'. He researched on various factors which

affect the wellbeing of a patient and came out with the salutogenesis model. The traditional health professionals consider the pathogenic model of disease prevention, treatment and management of disease as the path of better health, but Antonovsky brought in the concept of Salutogenic environment and its role in the process of patient healing and early recovery. He differentiated the two models by describing salutogenesis as a model focused on discovering the causes and precursors of health and identifying health.

Many researchers have worked on evidence-based research like Nilsson et al. 2011; Hendrich et al, 2008; Mroczek et al, 2005 and others have done substantial research which proves that physical environment has a positive influence on the physical and mental wellbeing of patients and their relatives during the stay in hospital.

Some recent studies have also shown that green environment helps in reducing stress levels, restore powers of concentration, and ease irritability, while correlations with strengthening of muscles and preventing aches and pain all over the body have also been noted (Nilsson et al.,2011).

Experiencing visually pleasant physical environment and surroundings reduces stress by eliciting positive emotions and restrict negative thoughts which eventually help in early recovery of patients (Parsons and Harting, 2000).

The ability of patients to influence and tackle situations or environments encountered during hospitalization is termed as 'Personal control'. This ability is directly linked to a patient's perception of emotional comfort. Personal control can be influenced by the nature of interactions with the hospital employees, routines, and the physical setting. Hence, factors such as hospital design and environment with its functionality can positively and negatively influence personal control along with patient's physical comfort and outcome.

According to international research personal space, sensory environment, smell, sound or noise, temperature, environmental complexity, fresh air and ventilation, natural and artificial light, color, viewing and experiencing nature, arts, aesthetics and entertainment constitute to a salutogenic environment.

These elements affect the most in hospital set-up, quite logically, because it is an environment where precious lives are at stake, high legal implications are palpable, outcomes can be fragile and unpredictable, and decisions that are justified by hard data and a lot of consultation. This draws the attention towards better Salutogenic hospital design to deliver the medical services for patients in a very stimulating environment that complements the healing process. A Salutogenic hospital design and environment helps alleviate stress preventing further harm to its patients

and customers visiting such healing environments for their care requirements as well as to the staff who are engaged in the care delivery process.

Given this understanding, the researchers have attempted to gather a more local perspective about Salutogenesis.

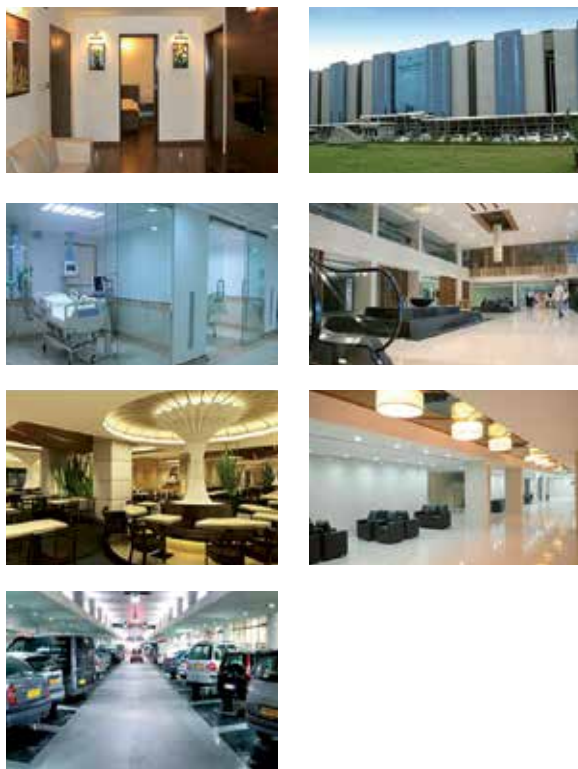
Two objectives were set for the purpose of this research:

- 1) To study conceptual understanding of the term “salutogenesis” on patient wellbeing in the Indian setting. Desk research revealed limited documented evidence in the form of research publications from Indian soils about awareness of the healing environment during the patient recovery process and general wellbeing in a hospital environment.
- 2) This led to the second objective to assess awareness amongst the hospital administrators and owners as well healthcare consumers about salutogenesis and environmental factors that could contribute to customer satisfaction.

The study was conducted

- a) Secondary literature review of published open source reports. Hospital website review to study use and application of design to their healing environments.
- b) Primary research using a focus group approach (FGD). The healthcare services professionals included those who had worked with hospitals and nursing homes, specialty clinics, dental centers, dialysis centers, ophthalmology centers, private private-partnership models, pediatric hospital, dietician centers, wellness services, etc. Based on pre-research findings a structured questionnaire was designed using open and close ended questions to facilitate understanding perceptions of both the stakeholders of healthcare. The respondents were chosen from all over the country using convenience method sampling. The questionnaire was completed through personal interviews for those in the city and email responses for those out of Mumbai city.

Seven Hills Hospital, Mumbai.



Public Private Partnership, Quaternary Hospital. Ergonomically designed, ambient interiors with huge underground parking in space crunch city delivering cost efficient care.

Surya Mother and Childcare, Mumbai and Pune.



Medical entrepreneur. Color, variety and spirit of fun.

P. D. Hinduja Hospital, Mumbai



View from room



Charitable Quaternary Hospital. Sea facing with connecting walkway and latest functional design in healing spaces)

Kokilaben Dhirubhai Ambani Hospital & Research Institute, Mumbai



Way-finding signage



Business centre and recreational activities



Disabled-friendly interiors



Pediatric Ward



Wall of Fame, confluence of art for healing environment

Godrej Memorial Hospital, Corporate Quaternary hospital using AYUSH aesthetics for healing).



Roof top garden



Ayurveda garden



Roof top garden

Findings

Hospital Administrator responses

The respondents were asked to note their observations of how patients and relatives spend their time at the hospital. The responses are reflective of the fact that when waiting at OPDs or during IPD stay, their mind and body is not relaxed and they exhibit stressful behaviors in the following manner:

- Sitting idle and ticking fingers, biting nails, etc.
- Starring at other patients or look around blankly searching something interesting or engaging.
- Playing games, web surfing or messaging using their mobile phones.
- Talking on their mobile phones.
- Scanning through magazines and newspaper.
- Overhearing conversation.
- Watching TV.
- Visit the cafeteria.

Minority of the respondents stated that patients and relatives go through the information brochures, go through logistics and cost issues concerning care, and in fact thinking what to ask their doctor during the consultation. In case of pediatric hospitals, the children are kept engaged through the play areas.

When asked their opinion about importance of design and aesthetic elements in patient care areas the responses included concerns to address patient anxiety, patient safety, provision of simple, calming and positive environment, strategic initiatives with customer segmentation, creation of enabling environment to improve employee productivity, as well as design being conducive for efficient and effective functioning, generation next customer experiences, etc.

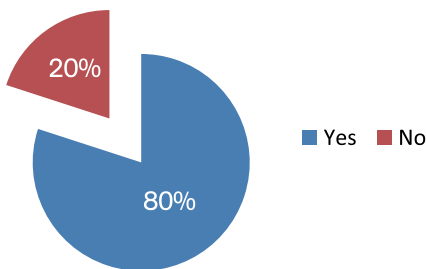
Factors important from a care delivery perspective, as an administrator or owner, the following was the ranking of the respondents:

- Quality processes
- Compliance to regulatory norms
- Cost control
- Corporate image
- Energy efficiency
- Industry trends
- Environment and employee productivity
- Suggestions from patient for improvement
- Interior design and ambience for patient recovery and mental calm
- Competitive strategy

Amongst the non-clinical environmental factors the respondents ranking of the design factors that could contribute to reduction in length of stay, faster recovery and customer satisfaction the following factors emerge to be important contributors:

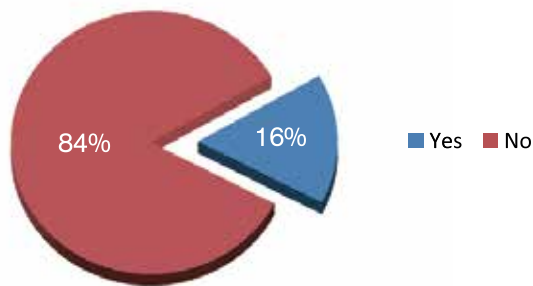
- Hospital ambience (light, temperature, other utilities)
- Hospital environment (smell and feel).
- Availability of patient assistive device (wheel-chairs)
- Ergonomic and designer furniture for patient and relative use
- Ease of navigation
- Availability of entertainment modalities during OPD, IPD, rehabilitation
- Music as an integrated part of therapy
- Color as an integrated part of therapy

Suggestions received from patients and relatives on hospital design, ambience, environment



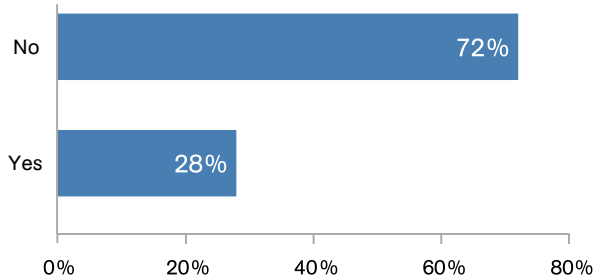
80 percent of the respondents have stated that they do receive suggestions from patients and relatives on hospital design, ambience and environment.

Awareness of the term 'salutogenesis'



It is interesting to note that only 16 percent of respondents are aware of the term 'salutogenesis', whilst a majority of 84 percent are not aware.

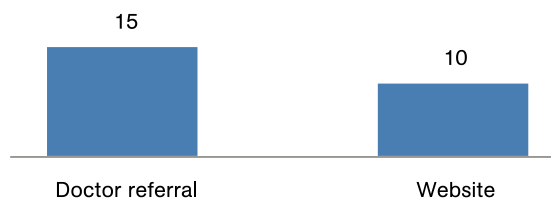
Design features – an expense to be best avoided in hospitals



72 percent respondents do not consider hospital design features to be an expense. 100 percent of respondents agree that hygienic environment with good ambience can contribute to patient loyalty.

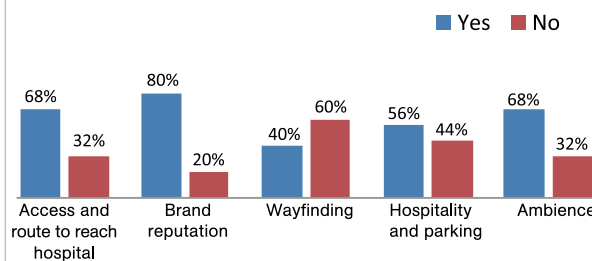
Customer Responses

Mode of Reference for selection of hospital



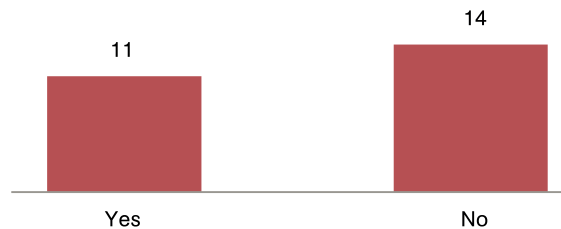
60 percent of the respondents select a hospital by their doctor's reference and 40 percent search through internet and official hospital websites.

Non clinical factors



Amongst the select sample, it was interesting to note that 66 percent people visit hospitals without further reference checks whilst an optimistic 44 percent of evaluate through personal checks, peer inputs, media reports, etc before making a visit to the hospital (in non-critical scenarios).

Evaluation of options



When asked on non-clinical factors important to decide visit to a hospital, 80 percent would consider the brand first however, 68 percent have identified ambience and external access route into the hospital as positive considerations with 56 percent weighing hospitality and parking with the remainder 40 percent claiming internal way finding.

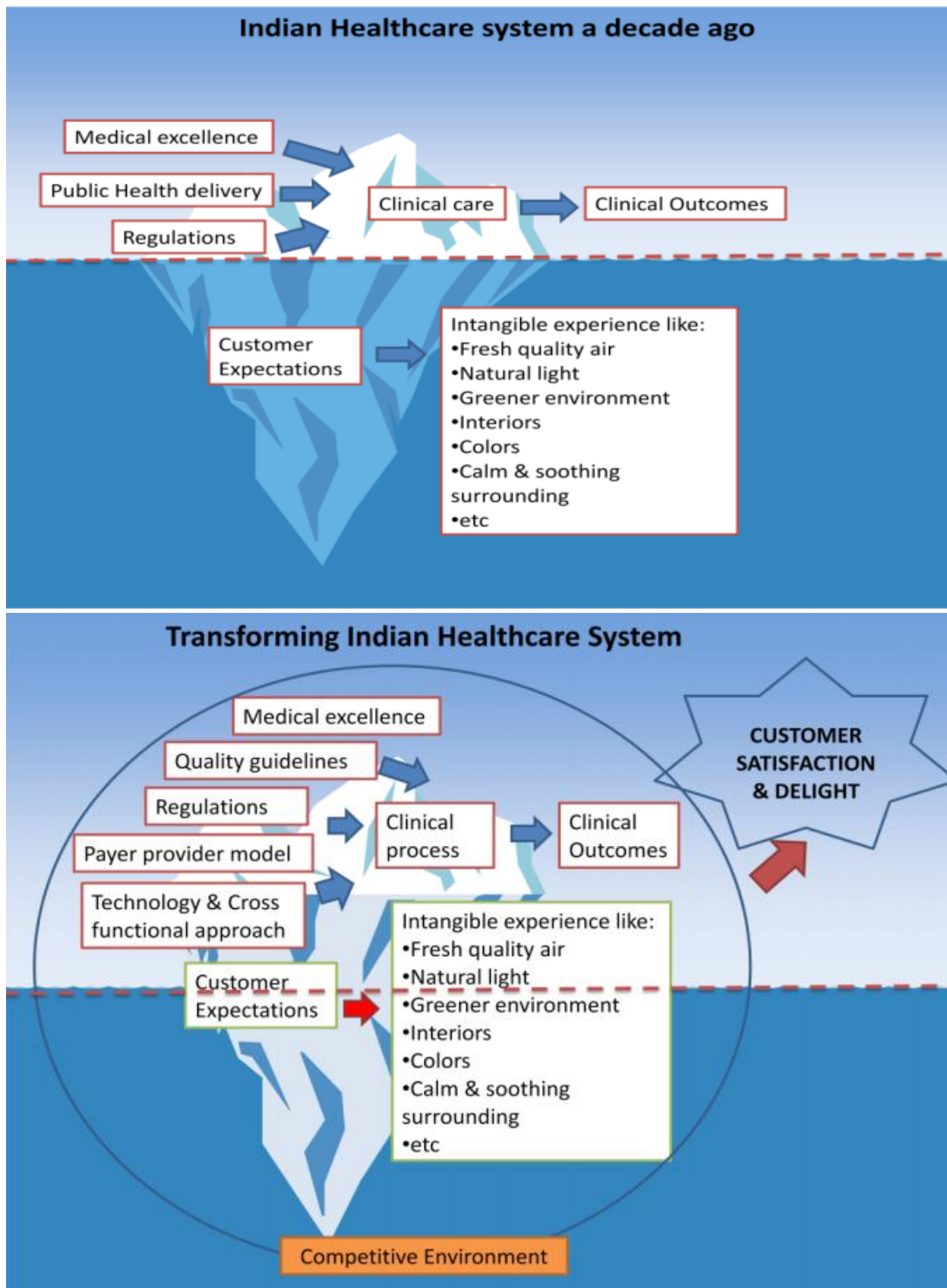


Figure 1 – The changing health care scenario (Authors perspective).

This image is depictive of the transformation that the Indian healthcare systems are undergoing. For international acceptance and inclusivity, India is on the global map, adopting and applying best practices of different cultures and sectors. The emerging domains of customer service, design and communications are imbibed and interwoven into the intricate and complex, but very dynamic health sector in India.

Discussion

Globally, health care service has been considered to be a state responsibility to deliver welfare services to the people, done so through its public sector machinery. Changing global business dynamics, socio-economic environments, medical and technological progress and increased international mobility, have all fuelled economic growth along with changing mindsets, rising customer expectations of service quality and value for money experiences.

The healthcare industry is transforming from the practitioner-driven model to corporate structures being accountable to all stakeholders. The look West apply East policy has helped in developing structured systems and business models for the healthcare services sector both on the clinical side as well as the business side. There is a constant endeavor by organizations to explore strategic and innovative ways of differentiation (Dagger et.al, 2007) going beyond customer satisfaction to customer delight, which in the health services sector is reflected through patient experiences and outcomes.

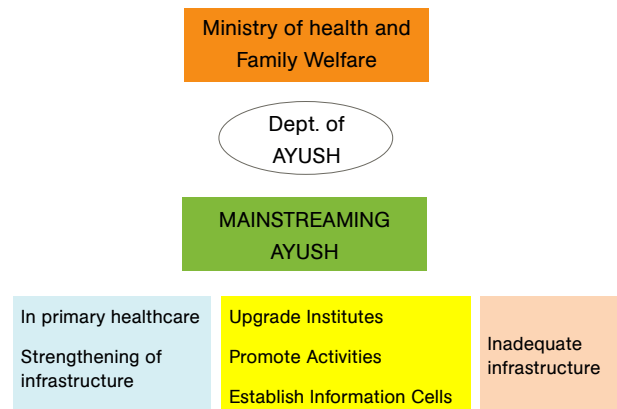
There are measures being taken to reduce healthcare inequality and provide access to affordable quality care, facilitated through budgetary allocation and infrastructure development, newer markets and their cultural and traditional sensitivities, innovative ways of financing, newer models of care, innovative models of business collaboration, medical leadership, increased demand, etc.

The golden rule 'Design should Follow Function' is co-created with involvement of multiple spokes of the wheel, including architects, designers, policy makers, employees, vendors, customers and it represented through the physical form, which is a living manifestation of the hospital's commitment to comprehensive collaborative integrated patient-centered care, environmental health and sustainability, an assurance of trust, positivity and human interface.

The patient care culture is changing, promoters and customers both desire hospitals to be more like a 'home away from home' during their care journey. It has been recognized that culturally acceptable ele-

ments of high aesthetic value would help rejuvenate the patient. Design teams are being recognized for their specialization. Within the budgets and cultural acceptance, there is freedom to express and blend the design and interiors sensibility for healthcare with due considerations given to people emotions, operational process flows and convenience in mind. The primary study also confirms these above research interpretations and we can conclude that it is the right time and place to be in given the fact that all stakeholders have recognized the implications of design and function compatibility for better patient outcomes, clinical coherence, competitive advantage, converging toward inclusive integrated transparent patient-centered care.

Way forward and applications



Typically the modern healthcare systems classifies hospitals as doctor entrepreneurs private nursing homes and hospitals, charitable trust hospitals, corporate hospitals, and public hospitals. But, India is a unified confluence of cultures, colors, races and religions. Allopathy (Western system of medicine) and corporate system of health care is looking East giving attention to Ayurveda (Hindu medical system), Yoga and Naturopathy, Unani (Greek system of medicine brought to India from West Asia by Muslim rulers of India), Siddha (specialized branch of Ayurveda) and Homeopathy (German origin) system of indigenous medicine. AYUSH has been an integral part of the Indian health care system and is known to take into consideration the needs related psychological, ethical, philosophical and spiritual well-being of a person, encouraging healthy living, in harmony with nature.

It is notable that these concepts do resonate with the World Health Organization's definition of health. Patients have been using these over the past hundreds and thousands of years and have developed

“...being able to see
out of a window,
instead of looking
at a dead wall...”

Florence Nightingale

renewed interests in these systems of medicine as supplementary to modern systems of medicine. There may be similar traditional medicine forms present in other cultures as well. The Indian government has encouraging plans to mainstream AYUSH, which creates an opportunity for infrastructure development with scope for design to be inclusive

and innovative to adapt to the specialized functional principles and practices of healing of such systems. Hence, there is good potential for the stakeholders of healthcare, including government, designers, practitioners, investors, employees, etc., to come together and co-create a world of trust of inclusive design and clinical excellence for health care. □

References

Ravi Duggal, Leena V Gangolli, Abhay Shukla, Introduction to Review of Healthcare in India, Centre for Enquiry into Health and Allied Themes, 2005, ISBN : 81-89042-40-8

Chittem M, Lindström B, Byrapaneni R, Espnes GA. Sense of coherence and chronic illnesses: Scope for research in India. *J Soc Health Diabetes* 2015, Vol. 3, pp.79–83.

Health Care at the Crossroads: Guiding Principles for the Development of the Hospital of the Future, The Joint Commission publication, 2008.

D. Banerji, Evolution of the Existing Health Services Systems of India, Book Review, *Medico Friend Circle Bulletin*, MARCH 1976, Centre for Social Medicine and Community Health. Jawaharlal Nehru University, New Delhi-110057.

Saurabh Ram BihariLal Shrivastava, , Prateek Saurabh Shrivastava, Jegadeesh Ramasamy, Mainstreaming of Ayurveda, Yoga, Naturopathy, Unani, Siddha, and Homeopathy with the health care delivery system in India, *Journal of Traditional and Complementary Medicine*, Volume 5, Issue 2, April 2015, Pages 116–118.

K. Vidhya, Dr. C. Samudhra Rajakumar, Dr. K. Tamizhjothi, An Empirical Study on Patient Delight and the Impact of Human and Non-Human Factors of Service Quality on Patient Satisfaction in Private Hospitals, *IOSR Journal of Business and Management (IOSR-JBM)* e-ISSN: 2278-487X, p-ISSN: 2319–7668. Volume 12, Issue 4 (Jul. - Aug. 2013), PP 20–27.

Ryash Vather, Kamran Zargar-Shoshtari, Patricia Metcalf, Andrew G Hill, The influence of hospital environment on postoperative length of stay following major colorectal surgery, *NZMJ*, Vol 120, No 1266, 30 November 2007, ISSN 1175 8716.

Websites

www.artforce.org
www.cehat.org
www.google.co.in
www.joshd.net
www.jointcommission.org
www.nzma.org.nz
www.sciencedirect.com
www.researchgate.net



Authors



Ragini N. Mohanty, a medical graduate, corporate-turned-academician is a general management professional with keen interests in health promotion and wellness through design, related to product, service or communications. She is engaged in actively promoting the concept of personal wellness. She holds interests in Design and Design Thinking as an innovator for Healthcare and invests her time and energies in crafting 'Entrepreneurship for tomorrow with a difference'. She has participated in design and innovation workshops with international agencies and has created concepts with basic prototypes for the themes of wellness-on-the-go, outdoor & indoor air quality, patient engagement, public hygiene being skilled for ethnographic research.



Prof. Anjali Chandra Kumar, holds a strong academic background with double Masters degree in Economics and Healthcare and Hospital Management from the premier B-school of India. Corporate personnel turned into academician and learner from nature, she is staunch believer in delivering quality Education and Innovation, specifically to Educational Methodology and Industry specific projects. She has participated in the Design and Innovation workshop and created concepts with prototypes for the themes of waste management, Health and hygiene. She has also mentored students in the Design and innovation space specific to Healthcare sector.



Prof. Richa Shah is a faculty of the Healthcare team, her expertise being in the area of Pharmaceutical Management. She is an MBA in Pharmaceutical Management from a national premium Institute. She is a Gold medalist in Marketing Practices and silver medalist in Consumer behavior.



ARCHITECTS
& ENGINEERS



Committed to quality of life for our senior citizens



致力于提高老年人的生活质量



VK delivers fully integrated architecture and engineering services for demanding healthcare clients worldwide who want to invest in healing environments in a constantly evolving society where our quality of life is under stress.

VK 为世界各地有意在治疗环境方面投资的投资者们提供完全整合的建筑及工程服务，跟着社会不断发展的同时，提高生活品质。

www.vkgroup.be



GPT OFFICES

CREATING CONTEMPORARY WORKPLACES

GPT OFFICES
SYDNEY

BVN.COM.AU



The Social and Economics of Healthy Ageing in China

Almas Heshmati

The need for healthy ageing is a challenge to many countries with a significant share of elder people. The literature refers to the China's ageing population as a ticking time bomb, a challenge and also an opportunity. Health is considered an important determinant of economic growth and competitiveness. The health of the older population determines its need for resources and care. Thus, investing in healthy ageing contributes to economic and social well-being. This study is a review of the literature on social and economics of healthy ageing. It aims to summarize the alternative approaches presented in the literature to ease the pressure from rapidly growing ageing population. Conclusions are drawn in respect with the conditions of healthy ageing in China and state policy.

Introduction

The need for healthy ageing is a challenge to all nations in particular for large countries like China with more elderly people than any other countries in the world. This will have an enormous impact on the Chinese society. The literature refers to the China's ageing population as a ticking time bomb. Some look at the growing ageing in China both as a challenge but also as an opportunity to influence the ageing development trend in desired direction. Health is considered an important determinant of economic growth, social well-being and competitiveness. The health of the older population determines its need for resources and care. This is particularly the case in societies with inclusive welfare services provision. Thus, investing in healthy ageing contributes positively to the labor supply and decreasing the likelihood of costly early retirement. It is crucial for the government to plan its ageing related policy and allocate health and welfare resources adequately for the future.

“Health is considered an important determinant of economic growth, social well-being and competitiveness”.

In addition to positive labor supply and reduced retirement and sick-leave costs there are some other positive and negative forces impacting healthy aging in China. The positive forces include: growth in the economy, higher education, technological development, increase detection and treatment of disease, and the availability of health insurance and health services. Furthermore, the age gap or inequality in longevity has been reduced in the society. The negative forces center on: disturbing trends in personal health behaviors such as growing rates of smoking, obesity and pollution. Other changes are related to rise in fertility rates and rural-to-urban labor migration leaving elderly parents separated from their expected care taking children.

This study is a review of the literature on social and economics of healthy ageing. It aims to summarize the identified alternative approaches presented in the literature to ease the pressure from rapidly growing ageing population. The main focus is on strategies for healthy ageing, policy practices and measures, organization, finances and manpower resources employed to promote healthy ageing. Conclusions are drawn in respect with policy and the conditions of healthy ageing in China.

Rest of the study is outlined as follows. Section 2 presents a review of the literature with specific focus

on determinants and evolution of health ageing, and its measurements. In Section 3 the state of healthy ageing in China is presented. The economics and policies of healthy ageing with emphasis on urban conditions is presented in Section 4. Various public investment programs and measures supporting healthy ageing are discussed in Section 5. The final section summarizes the findings and provides conclusions.

The Literature

This section provide a review of literature on the healthy ageing. The review accounts for the evolution of healthy ageing and its measurement.

As a result of development in the area of technology and education, the average life expectancy is increasing continuously. The general increase in mean age of the population regardless of location and level of human development is seen by Rasmussen et al. (2011) in their report a phenomenon that will bring social, political, economic and biomedical challenges for the current and future generations worldwide. Rasmussen et al. report predicted that by 2050, 33% of developed countries and 22% of developing countries population are over 60 years old. This is representing a doubling of the elderly fraction of the population worldwide. To meet the challenge the researchers use a multi-faceted interdisciplinary approach. The aim is to develop cost effective and efficient methods and reach consensus on how to allocate limited resources to meet the competing medical, social and economic needs and priorities of different age groups.

Several techniques are developed to measure health ageing. The progress is along both single and multidimensional measures with different focus on biological ageing, predictions of longevity and genetic healthy ageing.

Biological aging is a complex process. Lara et al. (2013) do not find a single, simple and reliable measure of how healthy an individual is ageing. The authors use the healthy ageing phenotype (HAP) in a large literature on lifestyle-based intervention studies. The aim is to identify the key features of healthy ageing and to identify or develop tools for measuring these features. The selected domains include physiological and metabolic health, physical capability, cognitive function, social well-being, and psychological and subjective well-being. These are expected to provide a holistic characterization of the healthy ageing phenotype. The authors propose a panel of outcome measures which could be deployed in community-based, lifestyle intervention studies. The authors

recognize that broader agreement on the concept of the HAP and on tools for its measurement is necessary to have a wider utility and to facilitate comparisons of healthy ageing across diverse lifestyle-based intervention study designs and studied populations.

A second approach to measure or predict healthy ageing is discussed by Vanhooren et al. (2009) who uses N-glycan profiles as measurement tools. Protein glycosylation is the most common form of co-translational modification of proteins. It increases the diversity of the functions of proteins encoded in the genome. The authors show that two N-glycan structures present in human blood glycoproteins change with ageing, and that one triantennary glycan is correlated with tumor stage in hepatocellular carcinoma patients. Therefore, an examination of alterations in serumglycan fingerprint by using the suggested platform could be a suitable tool for monitoring the healthiness of ageing and for assessing the effectiveness of ageing interventions. It could also be useful for detection and follow up of health conditions and monitoring the effects of treatment.

A third approach to measure healthy ageing is obtained from the integrated European project Genetics of Healthy Ageing (GEHA) that was initiated in 2004. The aim of the project was to identify genes involved in healthy ageing and longevity. Shytthe et al. (2011) mentions that in a first step, the project recruited pairs of siblings and a control group for each sibling pair from 11 European countries. A biological sample been collected from each participant, and information from basic physical and cognitive measures as well as health, life style, and family composition are obtained. From 2004 to 2008 a large number of nonagenarian siblings aged 90 years or more were identified and included in the project. Shytthe et al. view the GEHA project with access to a unique database to represent a unique source in the search for genes related to healthy ageing and longevity.

Healthy Ageing

This section presents the healthy ageing conditions in China. The aim is to identify policies and their implementations and outcomes to gain experience in formulation of appropriate policies in China to address the challenges of ageing population.

Health refers to physical, mental and social well-being as expressed in the WHO definition of health. Healthy aging is defined as the development and maintenance of optimal health and function in older

adults in a society. This is most likely to be achieved when communities are safe, actively promote health and well-being, and use health services and various community programs to prevent or minimize prevalence of various diseases. Active ageing is a policy that aims to extend healthy life expectancy and quality of life for all people as they age. Maintaining autonomy and independence for older people is a key goal in the policy framework for practices of active ageing in Europe. Europe has a well-developed welfare system with large investment in elderly care and quality of life.

Developing countries experience demographic changes in the form of lowered fertility and an increase in longevity leading to altered population age structure. China has more older people than any other country. According to the 2010 census, the number of people aged 65 years and older was 119 million, i.e. 8.9% of a population that is ageing fast and is expected to double in half of the time for Europe. By 2050, China's ageing population will match or exceed that of many of today's developed countries. The ageing in China has three distinctive features: (i) Chinese people by tradition rely on their family for old age support, (ii) China's population had a large decrease in its proportion of children as a result of the one child policy, and (iii) China is undergoing rapid urbanization characterized by a massive migration of younger workers from rural regions (see Zhou et al., 2014).

The ageing population in China is unique and accelerating reaching its peak by the middle of the 21st century. Dong and Ding (2009) find the range of products and scale of services and their qualities lag far behind the needs of the elderly. They attempt to identify ways to address the ageing population's needs. In meeting the increased needs and consumption demand, they suggest improving geriatric and gerontology education, and supporting elderly institutions and elderly care. They consider methods used by other countries as reference and adapt it to the local conditions. They suggest changes in the traditional elderly care by caretaker adult children and concepts of death by introducing hospice care.

The health of the older population determines its needs for care. There are some positive and negative forces for dynamics of healthy aging in China reviewed by Smith et al. (2014). The first positive force is associated with economic development and growth in technology and education. A second positive force is attributed to increasing detection and treatment of disease, and reforms that promote the availability of health insurance and health services as well as eased research transparency. The negative

forces center on disturbing trends in personal health behaviors such as growing rates of smoking, obesity and pollution. Other changes are related to rise in fertility rates, rise in continued migration leaving growing numbers of elderly parents geographically separated from their caretaker adult children.

In another study Wang and Chen (2014) discuss the way ageing challenges health care in China. According to China Research Center on Ageing (CRCA), the elderly population reached 202 million in 2011. More than 100 million have non-communicable diseases, 37 million have diabetes and about 23 million are older than 80 years causing pressure on the health care and widespread social concern. The authors point to disparities in access to health insurance and insufficient resources available to elderly care, leading to suboptimum services. An acceleration of the development of community-based primary health care for the elderly, improvement in basic knowledge about health, and investment in health education, promotion of health behaviors and scientific development are recommended.

Mohanty (2014) provide comments on Smith et al. (2014) suggesting a number of policy interventions to face the healthy ageing in China. One policy instrument is raising the retirement age with potential to retain older workers and utilize their experience to improve their financial security and sustained overall economic growth.

The Economics and Policies of Healthy Ageing

Economics helps to determine resources requirements allocated to alternative policies to address health ageing. It can help to identify different alternative care systems and their associated costs and benefits. Various methods are used to estimate program effects and to select cost effective care methods. The focus is increasingly on urban migration, infrastructure investment and healthy ageing and elderly care.

The economics of healthy ageing

The literature on ageing has developed rapidly. A selected list of studies focus on: population ages challenges for health care (Dong and Ding, 2009), the role of globalizing local knowledge system to diet and healthy ageing (Heinrich and Prieto, 2008), healthy ageing and home in five European countries (Sixsmith et al., 2014), the ageing of the Chinese population and the cost of health care (Hou and Li, 2011),

factors of successful ageing (Dahany et al., 2014), ageing, longevity and health nexus (Rasmussen et al., 2011), healthy ageing in China (Smith et al., 2014; Mohanty, 2014), health status and associated factors among the community dwelling elderly (Chao et al., 2013), measurement of the healthy ageing (Lara et al., 2013), and others.

With reference to 2050 projection Hou and Li (2011) suggest there will be about 115 million elderly citizens over 80 years old as a result of the 1979 one-child policy, requiring serious planning to cope with the demand. The authors provide quantitative measures of the elderly dependency ratio and the cost of medical insurance. The medical insurance premium varies greatly by coastal/inland, rural/urban and gender dimensions. Health care services have traditionally been biased towards urban population. Using the Taiwanese experience, Hou and Li propose incentive schemes to manage and reduce the cost of health care. A balanced development and investment in health is recommended to ease the burden of ageing population.

Qiu (2007) and Wang and Chen (2014) mention that a ticking time bomb is faced by China's ageing population. China has 6 million patients with dementia and, with a rapidly ageing population, it is estimated China will have 1 million new cases every year. It is predicted that by 2040 there will be as many people with dementia in China as in the rest of the world put together. Dong and Ding (2009) look at ageing in China both as a challenge and also as an opportunity. It is crucial for the government to plan policy and allocate health and welfare resources for the future. An attempt is made to identify ways to begin addressing China's aging population needs.

The Journal of the Economics of Ageing (Bloom and Eggleston, 2014) has published a special issue, where the focus is on economic aspects of population ageing in the world's two population superpowers: China and India. These countries have been the subject of comparison for many years. The aim here is to fill the gap in literature on their relative political and economic development, but little analysis is available of the possible economic consequences of demographic trajectories of their population ageing.

Urban healthy ageing

The largest human migration in history has been seen in China after the open door policy of 1970s. Migration has strong implications for public health services. Gong et al. (2012) using provincial data show evidence of a rapid trend in rural-to-urban migration. The growing city size and urban population together

with insufficient urban infrastructure, growing environmental problems and hazardous living environment, as well disease burden, are major urban public health challenges. To address these health challenges, Gong et al. suggest innovative health policies focused on the needs of the migrants. The authors list a number of economic, social and environmental push and pull factors driving migration in China.

The health status and associated factors such as community dwelling of elderly in certain district of Nanjing in China is evaluated by Chao et al. (2013). An elderly health assessment index computed using self-rated health indicators of different groups, suggests suboptimal general health status. The index dimensions include body function, self-care ability, emotional personality, and memory functions. The findings demonstrate that emotional and social support are more important than financial support for promoting the mental health of the elderly. It provides a basis for development of health management with focus on healthy ageing of the elderly in China.

Residential care is increasingly becoming an alternative option for many of the elderly in Beijing. Cheng et al. (2011) aim to shed lights on the well-being of elderly residents in residential care facilities and how the environment affects their everyday activities and health. From a perspective of health geographies, they seek to understand the relationship between ageing, health and living environment. The results show that physical and social environment and individual characteristics and family support influence their physical and sociological well-being. The study sheds light on future research used to cope with challenges of ageing Beijing.

Urbanization through demographic shifts affect human health and challenges urban sustainability involving balancing aspects such as culture, socio-economic, technical, environmental and ecological factors. Li et al. (2012) review the research on this relationship in Asia in countries with large populations and rapid urbanization. Urbanization offers both opportunities for improvements and also leads to problems with public safety, public health and social equity in East Asia. China is a major contributor to worldwide infectious disease burden. Japan provides many good examples of how to cope with the challenges to achieve urban sustainability by better understanding urbanization and human health.

The issue of healthy ageing at home in five European countries is studied by Sixsmith et al. (2014). They examine the relationship between home and healthy ageing. The data analysis identified five ways in which the elderly constructed healthy ageing with practice and policy implications including: home and



keeping active, managing life styles, health and illness, balancing social life, and balancing material and financial circumstances. Based on the physicality and spatiality of the home, research suggest a number of measures to enhance the notion of healthy ageing and creation of meaningful space.

Factor Influencing Healthy Ageing

This section provides a review of the literature on investments in healthy ageing that can have a positive effects on healthy ageing outcomes aimed to reduce social inequality, and the needs and costs of elderly care. The types of investments include changed views towards a multi-dimensional view of well-being, assessment of the effects of therapy on quality of life, investment in child health to foster healthy ageing, promoting dietary pattern, exercise habits with health linkages, the use of integrative approach to learning, community-based care, and emphasize on determinants of successful ageing.

Investment in well-being

Unlike the Marmot Review (Marmot and Bell, 2012) argument that societies should focus on reducing health inequalities by removing the unfair socio-economic gradient in health and reducing the social inequality, Canning and Bowser (2010) argue that a better goal is to improve health, income and socio-economic outcomes for the most disadvantaged in society through direct health interventions particularly in early childhood. Unlike the simple focus in economics on income per capita as a measure of well-being, they suggest a multi-dimensional view of well-being. Kim (2013) showed positive effects from therapy on the elderly in forms of reducing negative emotion, improving self-esteem, and decreasing anxiety.

The increased life expectancy has led to increased focus on the full ageing process including younger population in ageing research. Felix et al. (2014) develop a conceptual framework for child health treated as a dynamic state permitting optimal physical, mental and social functioning and optimal quality of life used as starting point for healthy ageing research. This conceptualization of child health and its dimensions can serve as a platform to build a framework with a broader focus on healthy ageing across the life course.

Healthy ageing and diet

Research shows that diet and health are strongly linked. There is tendency toward functionalizing food and tailor made for specific groups in the society. Diet is an efficient way to allow for healthy ageing. In an earlier study Heinrich and Prieto (2008) assessed how diet been evolved in the past century to make inference about diet in future. Of particular interest are the explanation of changes in dietary habits and their impacts on health as well as transitions from local to global and science-based evidence. Other characteristics than healthy, food must be convenient and easy to prepare. Thus, healthy ageing requires us to look at a multitude of aspects of foods.

A number of dietary patterns are associated with reduced risk for cardiovascular and age-related diseases. The traditional diet of Okinawa, Mediterranean, DASH diet and Portfolio diet are among such dietary patterns sharing characteristics and nutrient contents. The important shared features of these healthy dietary patterns include: high intake of unrefined carbohydrates, moderate protein intake with emphasis on vegetables/legumes, fish, and lean meats as sources, and a healthy fat profile. Together they reduce the socio-economic costs of chronic diseases burden and promote healthy ageing and longevity. Effective public health policies and programs can do much to mitigate

the risks and to help individuals to remain healthy as they age.

Along the same lines as those listed above, Zhao et al. (2013) investigate the empirical relationships between diet, chronic health outcomes and health information. They disentangle the effects of income on demand for health and the role of information on health status of consumers by adjusting their lifestyle toward healthier ones. Individuals are expected to adjust their diet in a healthier direction upon receiving negative health information. Based on Chinese data, they present evidence on the effects of hypertension diagnosis on food consumption reducing fat intake. Changes in food consumption and health outcome is influenced by level of education and income of individuals. Healthy dietary and exercise habits contribute to healthy ageing and quality of increasing life expectancy.

Other factor influencing healthy ageing

The increased life expectancy and the need to maintain health in older age is a key challenge facing government across the world. Shneerson et al. (2014) find the health systems based on biomedical model ill-suited to the complex needs of older people. The authors suggest an interpersonal education aimed to train multi-disciplinary health care students and members of community. The shared care and integrative approach to learning can be achieved by involving patients and public in collaboration to support healthy ageing. It is expected that the new approach will promote a better approach to healthy ageing.

Silva and Correia (2014) discuss ways in which web and telecommunication have brought beneficial changes to people's daily life. The elderly people have been affected by the digital divide. There is a need to suggest new solutions tailored to the needs of elderly. In order to understand how technology and social networking can enhance elders' lives and promote active ageing Silva and Correia discusses the challenges of adjustment to the new trends in emerging technologies. An example is ActiveBrain is a social online cognitive training platform. It covers brain training, stress sharing and elderly support to maintain the elders' interpersonal communications by being socially connected with others.

Summary and Conclusions

There is an increasing need for healthy ageing as an efficient way to address the challenges of rapidly increasing numbers of elderly people in China. The ageing population is referred to as a ticking time

bomb. Since health is an important determinant of economic growth and competitiveness, investment in health at an early stage will help to achieve optimal healthy ageing objectives and thereby reducing the resources needs and costs of care while contributing positively to economic and social well-being. This study provided a review of the literature on healthy ageing focusing on alternative approaches, policies, practices and resources identified to ease the pressure from an ageing population and their estimated benefits and quantified effects.

The major sources of increased number of elder people in China are the one child policy, education, technological progress, health insurance, improved material standards and rapid urbanization. These explain the continuous increasing life expectancy while deteriorated trends in lifestyle contribute to the increased need for costly health care. None of the former categories can or should be reversed, while the later behavioral factors can be influenced through investment in preventative measures to reduce long term resource needs in the long run and at the same time improve the general economic and social well-being in the society.

A summary of the present situation in China revealed that health in general refers to physical, mental and social well-being, while healthy ageing is defined multidimensionally as the development and maintenance of health and function in older adults. Its various proposed measures focus on biological ageing, protections of longevity, prediction of healthy ageing, and identification of genes related to healthy ageing and longevity. In recent decades there has been a growing awareness of the ageing problem and development of strategies to cope with ageing. There is evidence of social and economic benefits of such investments.

The current interdisciplinary research focus is on development of therapeutic interventions with high resource use priorities to enhance the quality of life and to develop cost effective care methods. While in looking at the limited resources to address enormous ageing problem, coping with health inequalities and fairness by reducing the distance between knowledge and policies, development of various integrative community programs, investment in education and public safety, diseases preventions, improved geriatrics, changes in care traditions, and cost effective interventions for chronic brain disorders are among active measures practiced. The relationship between home and healthy ageing, interpersonal and socially connectedness, health-diet linkage, maintenance of optimal cognitive, mental, physical, social relationships is an efficient way to perceive healthy ageing. □

References

- Bloom, D.E. and K.N. Eggleston (2014). Editorial. The economic implications of population ageing in China and India: Introduction to the special issue. *The Journal of the Economics of Ageing* 4, 1–7.
- Canning, D. and D. Bowser (2010). Investing in health to improve the well-being of the disadvantaged: Reversing the argument of Fair Society, Healthy Lives (The Marmot Review). *Social Science and Medicine* 71, 1223–1226.
- Chao, J. et al. (2013). Health Status and Associated Factors among the Community-Dwelling Elderly in China. *Archives of Gerontology of Geriatrics* 56, 199–204.
- Cheng, Y. et al. (2011). Aging, health and place in residential care facilities in Beijing, China. *Social Science and Medicine* 72, 365–372.
- Dahany, M.M. et al. (2014). Factors Associated with Successful Ageing in Persons Aged 65 to 75 Years. *European Geriatric Medicine* 5, 365–370.
- Dong, B. and Q. Ding (2009). Ageing China: A Challenge or an Opportunity. *Special Articles. Journal of the American Medical Directors Association* 10(7), 456–458.
- Feleix, J.F. et al. (2014). Health in children: A conceptual framework for use in healthy ageing research. *Maturitas* 77, 47–51.
- Gong, P. et al. (2012). Urbanisation and health in China. *The Lancet* 379, March 3, 843–852.
- Heinrich, M. and J.M. Prieto (2008). Diet and Healthy Ageing 2100: Will We Globalise Local Knowledge System? *Ageing Research Reviews* 7, 249–274.
- Hou, J.W. and K. Li (2011). The Ageing of the Chinese Population and the Cost of Health Care. *The Social Science Journal* 48, 514–526.
- Kim, S.K. (2013). A randomized, controlled study of the effects of art therapy on older Korean-Americans' healthy aging. *The Arts in Psychotherapy* 40, 158–164.
- Lara, J. et al. (2013). Towards Measurement of the Healthy Ageing Phenotype in Lifestyle-Based Intervention Studies. *Maturitas* 76, 189–199.
- Li, X.H. et al. (2012). Urban sustainability and human health in China, East Asia and Southeast Asia. *Current Opinion in Environmental Sustainability* 4, 436–442.
- Marmot, M. and R. Bell (2012). Plenaries. Fair society, healthy lives. *Public Health* 126, S4–S10.
- Mohanty, S.K. (2014). Comment on Smith et al. "Healthy Ageing in China". *The Journal of the Economics of Ageing* 4, 44–45.
- Qiu, J. (2007). In Context, Ticking time bomb faced by China's ageing population. *The Lancet* 6, July 2007, pp. 582–583.
- Rasmussen, L.J. et al. (2011). Meeting Report. Ageing, Longevity and Health. *Mechanisms of Ageing and Development* 132, 522–532.
- Shneerson, C. et al. (2014). Supporting healthy ageing: Training multi-disciplinary healthcare students. *European Journal of Integrative Medicine* 6, 104–111.
- Silva, M. and S. Correia (2014). Active Brain: Online Social Platform for Active and Healthy Ageing. *Procedia Computer Science* 27, 38–45.
- Sixsmith, J. et al. (2014). Healthy ageing and home: The perspectives of very old people in five European countries. *Social Science and Medicine* 106, 1–9.
- Skytthe, A. et al. (2011). Design, recruitment, logistics, and data management of the GEHA (Genetics of Healthy Ageing) project. *Experimental Gerontology* 46, 934–945.
- Smith, J.P., J. Strauss and Y. Zhao (2014). Healthy Ageing in China. *The Journal of Economics of Ageing* 4, 37–43.
- Vanhooren, V. et al. (2009). N-glycan profiles as tools in diagnosis of hepatocellular carcinoma and prediction of healthy human ageing. *Mechanisms of Ageing and Development* 130, 92–97.
- Wang, X.Q. and P.J. Chen (2014). Correspondence, Population ageing challenges health care in China. *The Lancet* 383, March 8, p. 87.
- Zhao, M., Y. Konishi and P. Glewwe (2013). Does information on health status lead to a healthier lifestyle? Evidence from China on the effect of hypertension diagnosis on food consumption. *Journal of Health Economics* 32, 367–385.
- Zhao, Y., J.P. Smith and J. Strauss (2014). Can China aged healthily? Comment. *The Lancet* 384, August 30, 2014, 723–724.

Author



Almas Heshmati is Professor of Economics at Jönköping University and Sogang University. He held similar positions at the Korea University, Seoul National University and University of Kurdistan. He was Research Fellow at the World Institute for Development Economics Research 2001–2004. From 1998 to 2001, he was Associate Professor of Economics at the Stockholm School of Economics. He has a PhD degree from the University of Gothenburg (1994). His research interests is applied microeconomics. He has published more than 150 scientific journal articles and more than 20 books on the EU Lisbon Process, global inequality, East Asian manufacturing, development economics, economic growth, and world values.



St Stephen's Hospital, Hervey Bay



Zhejiang Hospital, China

CONRAD
GARGETT

Designing healing
environments

conradgargett.com.au



Ngonyama Okpanum & Associates

ARCHITECTS | PROJECT MANAGERS | URBAN DESIGNERS | INTERIOR DESIGNERS | TOWN PLANNERS



Salutogenesis



“Space design, functional suitability and good spatial relationship of buildings improves the experience and quality of life of dwellers ”



Our Design Approach

HUMAN HEALTH,
WELL-BEING AND
EXPERIENCE



Ngonyama Okpanum & Associates

ARCHITECTS | PROJECT MANAGERS | URBAN DESIGNERS | INTERIOR DESIGNERS | TOWN PLANNERS



Socso Rehabilitation Centre Administration Block

A Breath of Fresh Air

Step into a government building, far from the usual drab institutional monolith

Wong Li Za

As we drive into the area, the semi-open, high ceilinged lobby of the administration building exudes a welcoming feel. Three skylights provide natural lighting in the porch, which is separated from the interior by a green-tinted glass panel. Walking inside, the familiar logo of Malaysia's Social Security Organisation (Socso) rests on the main wall behind the reception desk.

We are at the Socso Rehabilitation Centre in Malacca, the biggest and first such centre in Malaysia, and probably South-East Asia, that combines medical and vocational rehabilitation with an allied health institute. It is also the first rehab centre under Socso, which has 6.4 million contributors now.

"The whole concept of this rehab centre is in line with our objectives. We don't want to just pay out compensation and pensions, or merely give treatments to Socso contributors. We want to offer them a second

chance in life after an accident. We want to give them the opportunity to return to their jobs or at least equip them with living skills to manage themselves and be independent," says Datuk K. Selvarajah, Socso chief executive officer and director general, during an interview in Kuala Lumpur after our tour of the centre.

More than that, the centre – located in Malacca's Bandar Hijau, Hang Tuah Jaya – is proudly a green building.

"It's a good location, not very far from the Klang Valley. The piece of land was developed by Yayasan Melaka, who offered it to us. Bandar Hijau is a new growth area and we are one of the pioneer institutions there," says Selvarajah.

"The whole area is a green zone and is designated for institutional buildings. Going green is the order of the day and we wanted to adhere to the Government's objectives of being environmentally-friendly," he adds.



SRC overall master planning

The administration building is certified under Malaysia's Green Building Index (GBI), the green rating tool for buildings to promote sustainability in the built environment. According to greenbuildingindex.org, "a Green Building focuses on increasing the efficiency of resource use – energy, water and materials – while reducing impact on human health and the environment during the building's life cycle through better siting, design, construction, operation, maintenance and removal".

The firm that designed the centre is Arte Axis Design Group, which consists of Anuar Aziz Architect, Arte Axis Atelier and Arte Axis Interior. The centre's facades are built with low-e (low-emissivity) glass panels, which reflect 60% to 70% of heat. The cost of these panels for the administration block alone is RM6mil but, as Selvarajah points out:

"They may cost quite a lot but in the long run, it will save electricity costs."

Mokhlis Abdul Rahim, resident architect with Anuar Aziz Architect, explains further:

"The low-e glass panels are a key feature of this project. This type of glass reflects heat, leading to

lower energy needed to cool a room. It takes about five to seven years to get energy savings back from the low-e glass, so it is a viable solution in the long run," says Mokhlis.

Facades facing west do not feature glass panels, only concrete, to minimise heat inside the buildings. The buildings are also designed to allow natural sunlight and air in through skylights and air wells, by keeping ceilings high, and using an open concept interior design. The features succeed so well at introducing natural light that artificial lighting isn't required during the day – which is quite unusual for an office building.

The administration building lobby has no air-conditioning, as the high ceiling and other design features promote natural cooling. Insulating materials – including aluminium cladding – on the roof and certain walls are also used to keep heat out. To further reduce its energy footprint, the complex has a centralised air-conditioning system and water chillers.

"The Building Automation System with a smart thermal control feature allows chillers to be switched on at designated times automatically to suit operations and to achieve the required conditions and regulate usage. The system – which also controls the lighting – optimises energy saving and the comfort level of occupants," says Edmund Cheong, the centre's deputy director and head of administration.

Lights used are the LED (light emitting diode) T5 type, which uses 30% less electricity compared to regular lights.

Completed on July 31 last year, the complex also features a rainwater harvesting system – four underground reservoirs, each with a capacity of 4,540 litres, supply water for the landscaping's irrigation system. All roofs in the area serve as water catchment channels that direct the water into underground pipes. The water is then filtered before being stored in concrete tanks. A network of pipes all around the area operate by way of gravity, making use of the sloping grounds. Once the hoses are plugged in, the water will flow out, much like an aqueduct system.

Since the landscaped area spreads across 22ha, keeping the grounds watered is no joke. However, the centre's monthly water bill is only around RM6,000 a month thanks to the rainwater harvesting system. Street lamps all around the compound are solar-powered. Each street lamp system costs RM25,000. There are 75 systems in the entire area. The centre's buggies also run on electricity to minimise carbon emission.

Seventy per cent of the waste built up during the entire construction period was also successfully recycled. The centre is currently operating at one-



Low-e glass; façade aesthetic and energy saving

third of its full capacity. The current electricity bill is around RM170,000 a month, of which approximately RM110,000 is used to cool the buildings.

“When fully operational, the cost is expected to be RM420,000 a month on average, of which RM275,000 is expected to go towards cooling. I think for a facility of that size, it is very reasonable,” says Selvarajah.

The Socso Rehabilitation Centre was shortlisted for the World Architecture Festival 2014 Awards under the Health category. Although it didn’t win, being short-listed still served as a boost to Anuar Aziz Architect.

However the centre won the Silver Award under the ‘Public and Institutional’ Category of the 2015 PAM Awards (Pertubuhan Arkitek Malaysia – Malaysian Institute of Architects).



Medical Rehabilitation Block

The whole idea was to create a green rehab centre with emphasis on access for all. “When we talk about universal accessibility, it’s not just about the patients who come in but also the children and the elderly who may come and visit. This whole area is designed with equality and inclusiveness in mind,” says Datuk Ar. Saiful Anuar Abdul Aziz, managing director and principal of Arte Axis Design Group.



Natural contours and yet friendly for wheelchair users



The Primary Spine

Besides being wheelchair-friendly, all around the area are tactile floor tiles for the blind while for the deaf, there are vibrating beds in their rooms to warn them of a fire or other dangers. Developed at a cost of RM238mil, the centre is spread out over gently undulating land.

The idea was to work around the natural contours of the land, with minimal cutting or filling of soil. The lower part of the area contains a pond, while the main buildings are located on higher ground and well spread out.

“The challenge was in having the buildings far apart yet maintaining a slope gradient that is friendly for wheelchair users,” says Saiful.

That was how the idea of the primary spine came about, to balance the gradient from one point to another so that wheelchair users can move about with ease. This covered pathway connects all the buildings and is designed not only as a walkway and buggy path, but also serves as an exercise platform.

“It’s not all flat but has a slight gradient, because once patients go out into the real world, it will also be like that. So we want the environment to be disabled-friendly yet we do not want to spoil them,” explains Saiful.

Creepers have been planted along the sides of the pathways and trained to go over the top along trellises. There are also *pause stations*, or sitting areas, along the paths.

The medical rehabilitation centre is located next to the administration building and is designed in the shape of an open palm, hence it is fondly known as the “five fingers”. There are five rehab facilities there, which includes sensory services, physiotherapy, a hydrotherapy pool and a *work hardening* section.

Work hardening is the last therapy section that patients go through prior to returning to work to make sure they can function when they return to their jobs. It is also equipped with the latest facili-

“The budget is quite high but we believe that healing must be complemented by nature”

ties like the robotic rehabilitation system for patients with spinal cord injuries.

“We try to simulate their workplace environment and see what are the specific tasks that they do at work, down to the detail of the types of doorknobs, to prepare them to go back to work,” says Dr Hafez Hussain, deputy director and head of clinical rehabilitation at the centre.

From the start, the idea was to move away from the entire rehab centre having a typical hospital environment.

“When we walk into the centre, there must be a soothing effect, like walking into a holiday resort. Patients are going through a difficult period while under therapy, so we must give them motivation and encourage them during their rehabilitation and recovery period,” says Selvarajah.

Colour palettes are kept light for a calming effect. Extensive use of trees and various plants and creepers to create a garden concept to promote the healing and recovery of patients was incorporated.

A total of RM8mil was spent on landscaping. “The budget is quite high but we believe that healing must be complemented by nature,” says Saiful, adding that there are also pocket gardens with pergolas



The Sanctuary Garden



Colourful feature wall at the Sanctuary Garden

in between the five rehab sections that also serve as exercise stations.

An interesting area in the centre is the Sanctuary Garden located between the medical rehab block and the ward. It features an eye-catching wall comprising old style tiles painstakingly painted in different colours on the inside.

“We want patients to feel they are part of the outside environment in this open space. We played with colours in the tiles as part of the rehab element,” says Mokhlis, who showed us around the area with other staff from the centre.

Above the area is a steel roof designed like a hand-held, folding fan. “This roof serves as the best example of a wind tunnel,” adds Mokhlis.

Indeed, standing there, we could feel a consistent breeze passing through.

Leading the way in rehab

Since Socso Rehabilitation Centre took in its first patient on Oct 1 last year, it has received over 120 patients (as of Feb 13). At full capacity, the two hostels can accommodate 300 patients. Under Socso’s return-to-work programme, patients undergo physical and vocational rehabilitation so they can rejoin the workforce. Vocational skills offered include hospitality, sewing, electrical work, design and laundry.

“Spirituality is also very important in rehab,” says Saiful.

The centre’s surau is surrounded by the core buildings, with a design concept based on enlightenment. The roof curves towards Mecca and the building features aluminium louvre windows to promote natural sunlight and air flow. A section specially for the wheelchair-bound to perform ablutions with ease is also incorporated. For



Inviting entrance to the staff cafeteria.

non-Muslims, there is a spiritual, or quiet, room located in the hostels.

At the end of our site visit, we stop by the staff cafeteria, which features an aluminium-strip, curved ceiling that promotes air flow and creates more open space.

“The concept of green technology is a financially viable proposition. It’s also good for the environment and promotes cost savings in terms of utilities. The initial capital expenditure may be higher but in the long term, it will save costs. It’s a good model for other

institutional facilities,” says Datuk K. Selvarajah, Socso chief executive officer and director general.

“Other than its green features, the rehab centre is also the first of its kind in this part of the world to integrate physical rehabilitation with vocational training,” adds Selvarajah.

Since it opened, the centre has had visitors and delegates from different countries including China, Germany, Indonesia, and Japan who came to study the design and concept. □



Datuk Ar. Hj. Saiful Anuar Abdul Aziz

Principal, Anuar Aziz Architect

He completed his B.A (Hons) Architecture in 1987 at North East London Polytechnic and his Diploma in Architecture at Polytechnic of East London in 1990. Upon completing his RIBA Part III in the UK; he returned to Malaysia in 1992.

He incorporated Anuar Aziz Architect in 2000; subsequently forming Arte Axis Design Group into an award winning boutique multidisciplinary design practice specialising in sustainable build environment. The Group specialises in Healthcare Facilities, Master Planning, Innovative Architecture and Creative Interior Design.

His design philosophy was influenced by his tutor Ms Christine Hawley and her partner Professor

Sir Peter Cook at the heights of the Deconstructivist architectural movement. Keeping to the spirit of deconstructivist design principles, manipulation and complication of geometry was applied to the functional, structural, and spatial aspects of the building designs.

His architecture language is intellectual and research-based. The works evolved from an evolutionary design process, exploring and testing ideas while focusing on the Clients’ objectives, functional discipline and value added design. Designs are site specific where environmental issues are resolved by incorporating green design principles while ‘salutogenic’ design ideas are sensitively incorporated.



SOCSO Rehabilitation Centre, Malacca, Malaysia

Administration Block

Medical Rehab Block and Sanctuary Garden



Arte Axis Design Group (AADG) Office, Petaling Jaya, Malaysia



Main Reception Area



General Office Area



The Tree Pillars, Sabah, Malaysia



ABN Broadcasting MediaHub, Kuala Lumpur, Malaysia



Darulaman Teaching Hospital, Kedah, Malaysia

Local Expertise World-Class Aspiration

Specialised in:

- Healthcare Facilities
- Masterplanning
- Innovative Architecture
- Creative Interior Design



ANUAR AZIZ ARCHITECT (a member of Arte Axis Design Group)

601 C, Level 6, Tower C, Uptown 5, No. 5, Jalan SS21/39, Damansara Uptown, Petaling Jaya, Selangor, Malaysia.

Tel: +603-7726 3875 Fax: +603-77263894 Email: admin@arte-axis.com Web: www.arte-axis.com FB: www.facebook.com/ArteAxis



Macau Island Hospital, Pediatric Clinic.

Innovation in the Healthcare Industry

Angela Lee, Kenneth Webb, Andrew Jaeger / Editor: Brinda Sengupta

Healthcare challenges are faced by every country, and even more so in the face of the ever changing technological and social landscape. Asian countries are no exception to these challenges. While developing countries like Cambodia struggle to improve public access to basic healthcare services, addressing contagious diseases and infant mortality, developed countries like Japan battle challenges of a rapidly ageing population together with a rise of illnesses such as diabetes, cancer and cardiovascular diseases.

Addressing these challenges calls for innovation: to manage healthcare with greater efficiency, ensuring better healthcare quality for a greater number of patients, and for reduced costs. Innovation is not confined to technology, but extends to design, research, financing, regulations and partnerships.

In this paper, our aim is to explore ways to advance the quality of patient care by creating and embracing healthcare innovations and developing scientific knowledge in which design and technology play a central role. As architects, designers and medical planners, we envision design as good platform to innovate and also provide patients with better healthcare experiences. This paper outlines the top five trends in innovation – Clinical Lab Design, Emergency Disaster Preparedness, Clinical Care Team, Neuro-Architecture, Lean Design Process, each illustrated using the new Macau Island Hospital as a case study.

CLINICAL LAB DESIGN

Healthcare design has always focused on the patient-centred spaces such as patient rooms. On the other hand, clinical laboratories are among the hospital's most important spaces where specimens are tested, and are gaining increased attention in terms of architecture and design planning. The objective is to design a clinical lab environment that is more efficient and effective in managing the flow of staff and specimens.

Open plan design

The latest lab design concept is the Open Plan, or Big Room concept, featuring wide open spaces with no interior walls. This allows greater flexibility and the layout to be reconfigured as necessary. Power, data and gases are mounted overhead, rather than provided through the floor or walls. Modular case-

work, which is often equipped with wheels for easy relocation, is used instead of fixed cabinetry. Sinks and floor drains, which cannot be moved without major construction, are placed in areas that are unlikely to change, such as along aisles and walkways. Drains are also installed in a regular grid formation throughout the lab, then capped or uncapped as needed.

This arrangement is especially useful with analyzers that require a de-ionized water feed, and need access to a nearby drain to discharge waste water. Using this type of design, a lab director and technician could reconfigure a portion of the lab themselves over a weekend to add an analyzer, and have it up and running for testing on Monday. There's no need to engage a contractor or the hospital's construction services department to put up temporary barriers, cut down gypsum board and stud walls or reroute plumbing. Hospitals don't have to develop phasing plans or suspend operations to update lab workspace. This gives the advantage of flexibility, efficiency, as well as saves great amount of time, money and unnecessary manpower.

Automated testing

Automated testing systems are an advancing lab technology that is facilitated by open plan lab design. With traditional standalone analyzers, technicians tend to batch specimens until there is enough for a full load, before placing specimens onto each analyzer, run a batch, then unload the analyzer when testing is done. Standalone instrumentation often requires a high number of technicians, as one technician can only load, unload and monitor a small number of analyzers at any one time.

In an automated system, analyzers are arranged along a robotic track that operates much like a conveyor belt. Technicians load individual specimens onto the track in real time as they arrive at the lab. The automated system handles everything from de-capping and re-capping tubes, allotting specimens and labelling the new tubes, delivering them to centrifuges as necessary, loading them onto the appropriate analyzers for testing and automatically storing and archiving them until they are ready to be disposed of. Such automated systems are able to retrieve a specific specimen often days later and re-run it for additional testing, all without a technician ever having to touch the specimen again.

Depending on the number of analyzers, automated systems may involve 50 to 60 feet of linear track that is bolted to the floor. This automation line functions as the backbone of the lab. It should be located where

it won't act as a barrier or bisect any traffic or work flow to other more manual testing areas of the lab. In addition, the front end, or pre-analytic section of the line should be placed as close as possible to where specimens come into the lab. Ideally, a specimen processor sitting next to the lab's pneumatic tube station will be able to take specimens out of the tube and simply turn in his or her chair to drop the specimens directly into the inlet of the automated testing line, with no wasted movement or time.

Because most automated lab systems are scalable, they function well in labs with open plan designs. A lab can start, for example, with two chemistry analyzers; in a few years, the lab could easily extend the line to include a third analyzer. Or, the lab could replace an analyzer with one that can perform a higher number of tests per hour. The open plan design allows for future modular growth with minimal readjustment needed to the lab layout. For the most part, the more you can automate, the better.

Almost every time you have a technician doing something manually by hand, it slows down the procedure and increases the error rate. By automating repetitive processes, you can make the most of the intellectual capital of highly skilled, highly trained technicians. Instead of spending their time preparing specimens or slides—mechanical duties that can consume their work days—they are able to do what they do best, which is using their cognitive problem-solving skills to analyze results.

Genomics

Another potential healthcare revolution is developing within the world of genomics, a genetic discipline that applies recombinant DNA, sequencing methods to sequence and assemble genome structures. It is found that genetic factors play a role in nine of the ten leading causes of death in the United States.

Popular biotech and pharma companies are concentrating on certain diseases such as acute lymphoblastic leukemia, breast cancer, cystic fibrosis, heart disease and diabetes, all of which have genetic components which could be addressed with a genomic approach. Investment entry-points include biotechnology, pharmaceuticals and research and testing facilities. Genomic studies in cancer treatment, for example, can be used to develop clinically validated tests providing the genomic profile of a patient's tumor and can help understand whether patients are likely to respond or benefit from cancer treatment and therapies. This could help healthcare providers better treat patients and manage their disorders with greater understanding.

Future growth and change

Well-designed clinical labs provide an ample amount of space for maximum flexibility that enables labs to grow, change and adapt for the future. It also provides the infrastructure needed to take advantage of the latest developments in technology and medicine. Sufficient power and data, robust heating and ventilation, careful design of engineering systems, smart selection of appropriate materials and finishes are critical to create conducive clinical laboratories for relevance of use in the long term.

Case Study: Macau Island Hospital

With relevance to the above consideration in clinical laboratory design and planning, similar concepts are adopted as part of the architecture and interior planning of the new Macau Island Hospital in Macau, SAR.

The physical design of the clinical lab and the quality of systems implemented are flexible and versatile enough to accommodate not only hematopoietic stem cell processing, but also adaptable to introduce a wide range of potential cellular and gene therapeutic projects and trials in the future. This facility is designed to be ready to apply for the following accreditations/certifications/registrations:

- CAP accreditation
- AABB accredited
- FDA registered
- FACT/ISCT accredited
- JACIE accredited
- ASHI/EFI accredited

CTAG testing and processing areas:

The Cell Processing laboratory has been divided into three areas;

1. The first area is a GTP / GLP (Current Good Tissue Practice / Good Laboratory Practice) lab which is designed to accommodate all routine blood processing for both autologous and allogenic blood collection as well as Umbilical Cord Blood processing for cryopreservation.
2. The second area is a cGMP (Current Good Manufacturing Practices) Lab which is utilized for more advanced applications, such as cellular mediated immune responses and invitro immunological testing.
3. The third area is the Transplant Immunology laboratory, and is designed to test for histocompatibility between donors and recipients, along with more basic testing methodologies. It contains Flow Cytometry, a Molecular diagnostic and therapy lab,

including Genetic Pathology, Cytogenetic, and HLA (Human Leukocyte Antigen) testing. Because all these functions are highly related to each other, the Transplant Immunology laboratory has been designed as one large open laboratory space, which facilitates staff interaction & cross training besides providing a flexible space which is easily reconfigurable as testing methodologies and equipment continue to evolve and change in the future.

The cGMP Laboratory consists of:

- “Clean Rooms” for Routine Cell Processing. Each Processing room is Positive pressure; ISO-Class 8 (Class 100,000) accessed via ISO-Class 8 (Class 100,000) Ante-Rooms shared between the two processing rooms. The ante rooms are positive pressure relative to the surrounding corridor, but at negative pressure compared to the Cell Processing rooms.
- “Clean Rooms” for Cell Therapy, these rooms will be at Positive pressure, ISO-Class 7 (Class 10,000) accessed via an ISO-Class 8 (Class 100,000) Ante-Room.
- And two negative pressure “Clean Rooms”; one for Gene Therapy and one for Viral Vectors.
- A dedicated specimen reception area is provided for incoming materials. Staff Lockers are built for gowning & de-gowning. A Decontamination Room and dedicated Housekeeping Room are also part of the cGMP Suite.

The Cytogenetics Laboratory includes:

- A Tissue Culture Room (Positive pressure ISO Class-8/Class 100,000)
- A Cell Harvest Room (Positive pressure ISO Class-8/Class 100,000)
- A Dark Room
- Routine Karyotyping, including human chromosome analysis, Karyotype characterization of new cell lines, confirmation of cell line identity or integrity and high resolution chromosome analysis.
- A Banding Zone
- Workstations for Genetic Analysis
- BAC Array Workstations
- CGH (Comparative Genomic Hybridization) utilizing Conventional Chromosomal CGH and BAC Array CGH FISH validation.
- FISH (Fluorescence in situ hybridization) Processing
- Various assorted Immunological and Serological testing
- Tissue Storage/Cryopreservation

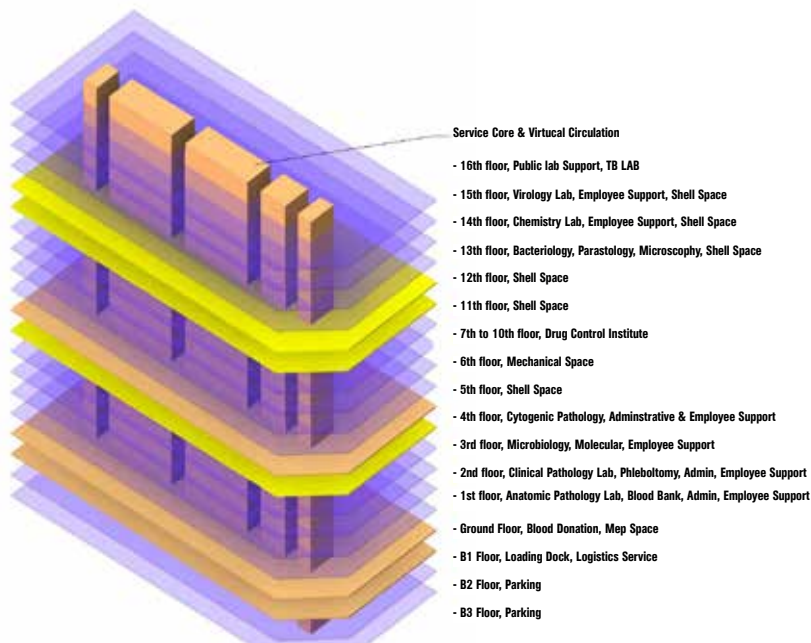


Fig.1: Lab Building, Open Plan Design

EMERGENCY DISASTER PREPAREDNESS AND PANDEMIC OUTBREAKS

At the frontline of Emergency and Disaster Preparedness with a Spotlight on Potential Pandemic Outbreaks around the Globe

Emergency and Disaster Preparedness have become significant drivers affecting emergency and hospital design across the world. Events ranging from tsunamis, tropical storms, potential terrorist attacks and pandemic/contagious disease outbreaks have impacted the design of physical facilities and hospital operations in order to safeguard the public during quarantine and pandemic events.

Today Health Systems and Hospital Facilities across the globe are challenged with the issues associated with pandemic events that are becoming more common and could have significant impacts on large segments of the population. Events over the course of the last decade, including outbreaks of H1N1, SARS and the recent outbreak of Ebola, have raised considerable concerns about how to control and isolate patients with potentially highly contagious diseases.

The CDC (Centre for Disease Control) and other worldwide health agencies have helped to define recommended protocols that establish infection control measures for varying levels of control of health related transmittable contagions and diseases. New recommendations are being formulated and developed to respond to constantly evolving infectious diseases and knowledge gained from the treatment of these health issues. Agencies around the world are re-evaluating the level of infection control and isolation based on worldwide concern over the transmission of potential pandemic diseases.

The recent media exposure around the Ebola outbreak in West Africa has only highlighted the need for sophisticated solutions effecting infection control operations and facility designs to support the operations. HKS has been at the forefront of emergency preparedness issues and its impact on facility design for the last decade. Many of the ideas that were conceived in the design concepts of the Washington Hospital ER One project in Washington, DC are still being implemented and improved upon today. Project ER One was the first of its kind in the United States and was on the leading edge of design for the time.

The ER One concept focused on three goals: scalability that conforms to fluctuating patient volumes, medical consequence management to allow continued operations

in the midst of unknown events, and threat mitigation to help prevent and mitigate the effects of intentional harm or adverse natural events. Each of these concepts have been influential in helping to define how we begin to consult with our clients on the design of facilities and how these design solutions can promote safety, efficiency and complement the efforts of the care givers during difficult emergency scenarios.

Macau Island Hospital Pandemic Outbreaks Readiness

HKS was engaged by the Macau Health Bureau in the winter of 2014 to consult on the design of a new 1200 bed Macau Government Hospital Complex in Macau, SAR. As the HKS team began to conceive the design and planning for the new hospital complex, emergency and disaster preparedness were key elements of discussion during design phases.

The new facility was designed with several key elements that support the hospital's objectives for meeting emergency and disaster preparedness initiatives.

Key Design Elements

- Departmental Compartmentalization
- Expandable/Convertible exterior space
- Mass Casualty Decontamination Design Solutions
- Dedicated Patient Transfer Elevators
- Emergency Observation Unit Conversion to Pandemic Isolation Floors
- Mechanical System Infrastructure (Seasonal/Pandemic Exhaust Design)

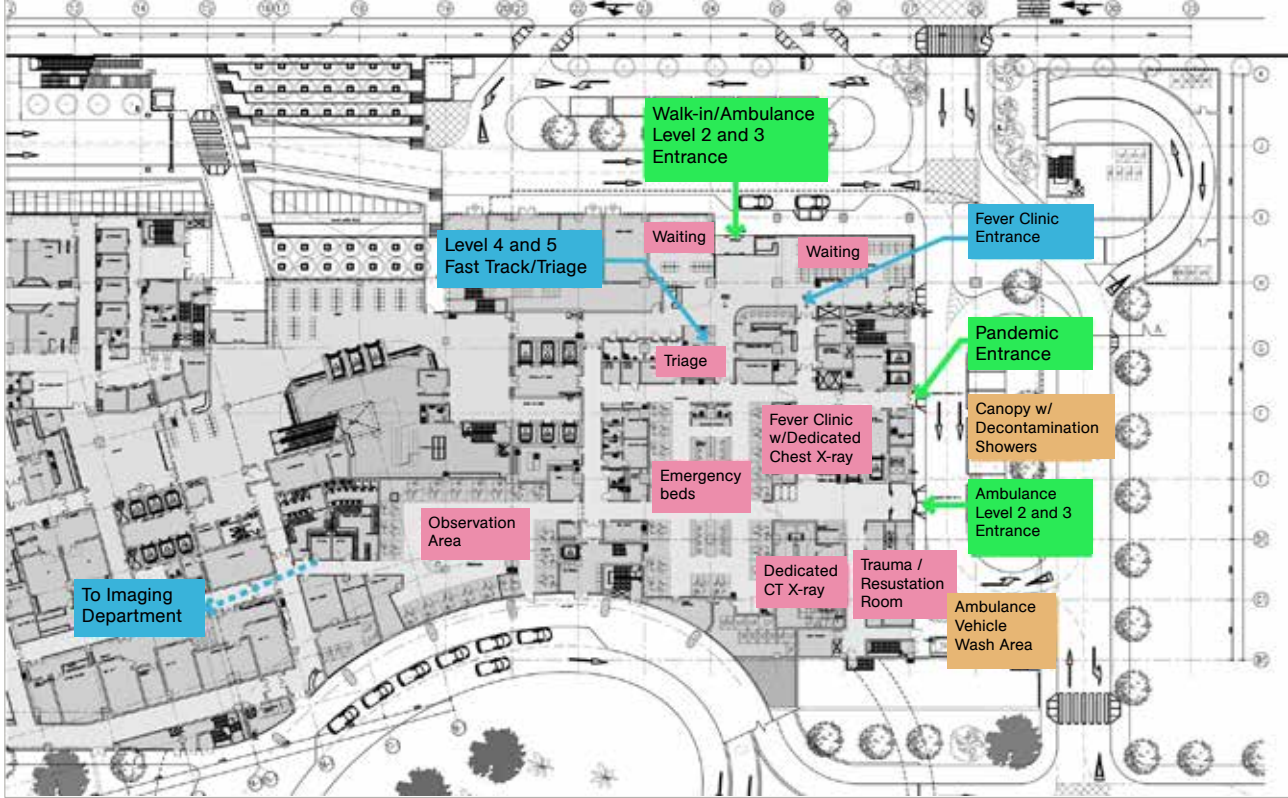


Fig. 2: Macau Island Hospital, Emergency Department

Emergency Department Design

The Emergency department was designed to operate under normal circumstances with 6 key zones including a Fever Clinic, multiple floors with 23-hour emergency observation, Level 1 Trauma/resuscitation rooms, Level 2 and 3 emergency room beds, Level 4 and 5 Fast Track/Triage area and dedicated CT and Radiology Imaging services.

The final design (figure 2) was developed to allow for compartmentalization into multiple zones which provide isolation and expandability during a mass casualty or pandemic outbreak. The department was designed in such a way to allow for a portion of the emergency department to be isolated for a mass casualty or contagious outbreak, while at the same time allowing for the main emergency department to remain operational. Both the interior of the emergency department as well as the exterior were designed to allow for expansion and compartmentalization.

Several design features (figure 3 a–b) are integral to allow for the expansion of exterior Emergency drop-off area into a temporary triage area and separate decontamination area that allows for the treatment of potentially contagious or contaminated patients.

- Structural davit connections or permanent ceiling mounted tracks can be provided to accommodate temporary fabric partitions or curtains.
- Strategically located hose bibs with shower heads for decontamination of patients
- Trench drains with dedicated plumbing diverted for decontamination



Fig. 3 a: Decontamination Shower



Fig. 3 b: Decontamination Shower Trench Drain

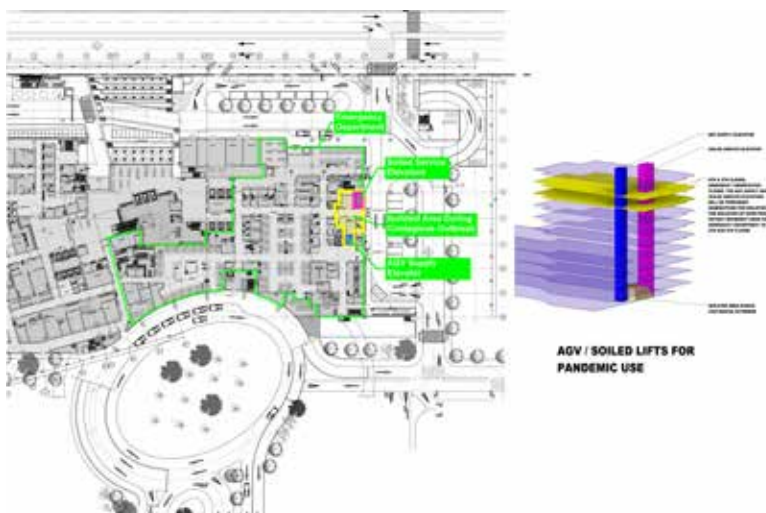


Fig. 4: Elevators.

In order to provide sufficient accommodations for isolation of large patient populations during quarantine events, it was necessary to provide dedicated vertical circulation access to multiple levels of the facility (figure 4). This access was coordinated to allow for the segregation of these isolated floors while also maintaining vertical circulation capabilities for the remainder of the hospital tower to allow for normal operations to continue during quarantine and pandemic events.

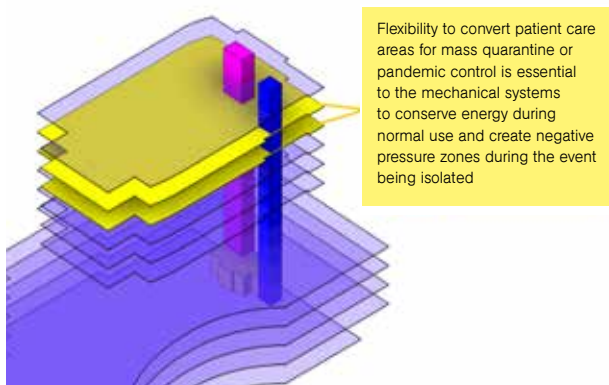


Figure 5. Flexibility for disaster preparedness.

The AGV Supply and Soiled Service Elevators will be temporarily quarantined for isolation of infectious patient movement from the emergency department to the isolated emergency observation floors on levels 8 and 9 (figure 5).

While the physical design and planning of the facility were instrumental in creating pandemic zones within the facility, it was imperative that a mechanical strategy be implemented to compliment the design and provide true isolated zones within an operating hospital. This required mechanical systems

which were designed to allow for the compartmentalization and isolation of several zones during seasonal flu season or potentially pandemic events.

While providing flexibility to convert patient care areas to negative pressure zones during mass quarantine or pandemic events is crucial, the solution must also be designed to conserve energy during normal use. Areas programmed for quarantine isolation zoning are typically areas that are not fully exhausted during normal operation. Operating these areas with full exhaust during normal operation would increase the energy required to condition the necessary extra outside air. Using strategically placed dampers and direct digital controls energy can be conserved and the isolated areas can still be converted to negative pressure with minimal effort or disruption (figure 6).

isolated areas can still be converted to negative pressure with minimal effort or disruption (figure 6).

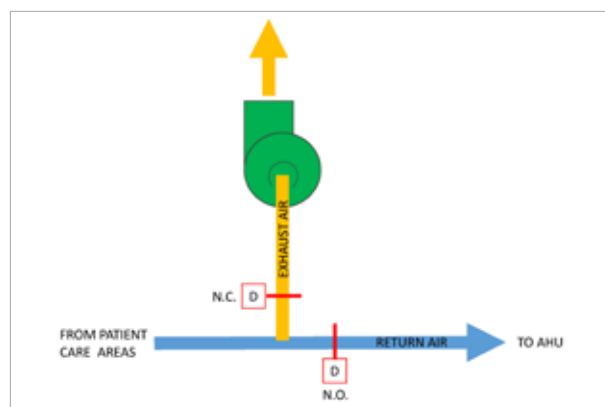


Fig. 6: Damper with Digital Control

During normal operation the return air damper is open, the exhaust damper is closed and the air handling unit is only bringing in the minimum amount of outside air required for the space. However, when the area is under isolation a command can be sent from the controls system to close the return air damper, open the exhaust air damper and also open the economizer damper in the air handling unit. When the damper positions are confirmed by the controls the exhaust fan starts, the area becomes negative pressure and is isolated from spreading contamination to adjacent patient care areas.

Conclusion

As the public’s awareness and fears of the transmission of pandemic diseases grows there is sure to be a continued impact on how we design our health facil-

ities to assist caregivers on the front line of defending against large outbreaks of contagious diseases in major metropolitan areas. Our hospitals and systems must be designed with the intent to provide greater assistance in the control and spread of such diseases while minimizing impacts on the existing operations of the facility.

CLINICAL CARE TEAM – Designing for a change-ready future (CADRE, 2015)

The rising healthcare costs in the United States have been an ongoing concern for policy makers, healthcare providers and patients. In a recent Commonwealth report¹ it was found that compared to 10 other developed countries the United States spent the most on healthcare, while the quality of care was rated amongst the lowest.

This finding, and many previous reports on escalating healthcare costs, have brought about an urgency to change healthcare and bring about systemic and system-wide reform. Needless to say the ripple effect of the systemic change has been felt in the design and construction industry as well.

The healthcare landscape is shifting, and one of the manifests of this shift is the growth in ambulatory care. According to a 2014 report from the Advisory Board (figure 7), based on feedback from 38 hospitals and healthcare systems in the United States, over the next 3 years construction in ambulatory facility (retail clinic, urgent care, free standing EDs, imaging

centers or ambulatory surgery centers) construction is projected to grow by 71%, medical office buildings by 53%, inpatient towers by 41%, specialty hospitals by 15% and post-acute facilities (skilled nursing facility, long-term care hospital, hospice, rehab, and senior living) by 12% (figure 8).

Given the rise in outpatient care and overall construction, needless to say the A/E and construction industry is quickly assessing how they can respond to the shifting landscape. Many “ambulatory care of the future/ clinic of the future” reports are out there, and each provides a valuable insight for the industry. But what does “designing for the future” really mean? In an era of hyper-connectivity, personalized medicine and wellness initiatives on one end, and changing health management systems and insurance models on the other- what role do clinics play, and how will our facilities accommodate these roles? Will clinics be bigger or smaller, more specialized or diversified?

As diseases and their treatments get more complex, the core skillset of the physician has also needed to advance. Unfortunately, this has resulted in a growth of specialists disproportionate with the growth of primary care physicians, who are the first point of contact for a patient. This disparity, coupled with the growing shortage of physicians overall, has forced the provider model to change.

We are seeing a growth of new care team members, such as the physician extender/nurse practitioner (who can take on some of the physician responsibilities), and physician/medical assistants who team with the key care provider to provide team-based care. Additionally, with a focus on whole health, a growth in ancillary support for the entire team via health coaches, case managers and behavioral health specialists has increased. We also are seeing the need for more technical knowledge due to the advances in the field, technology and electronic health records.

According to a report from the Leonard Davis Institute of Health Economics, since the early 1980s, many surgical procedures have moved from the inpatient to the outpatient setting, with outpatient surgical visits now accounting for about two-thirds of all surgical visits in the United States. In part, this shift has been accommodated by the advancement in technology, including miniaturization of diagnostic equipment ranging all the way from handheld X-ray machines and portable ultrasounds to 3-D printing of medical (especially dental) implants. Smaller diagnostic equipment, wearable technology and the ability to remotely monitor health are transforming healthcare.

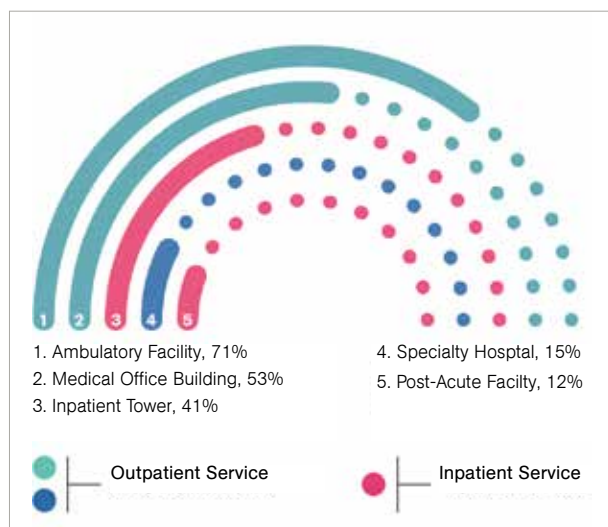


Fig. 7: Projected Growth in ambulatory care construction projects in the next 3 years.

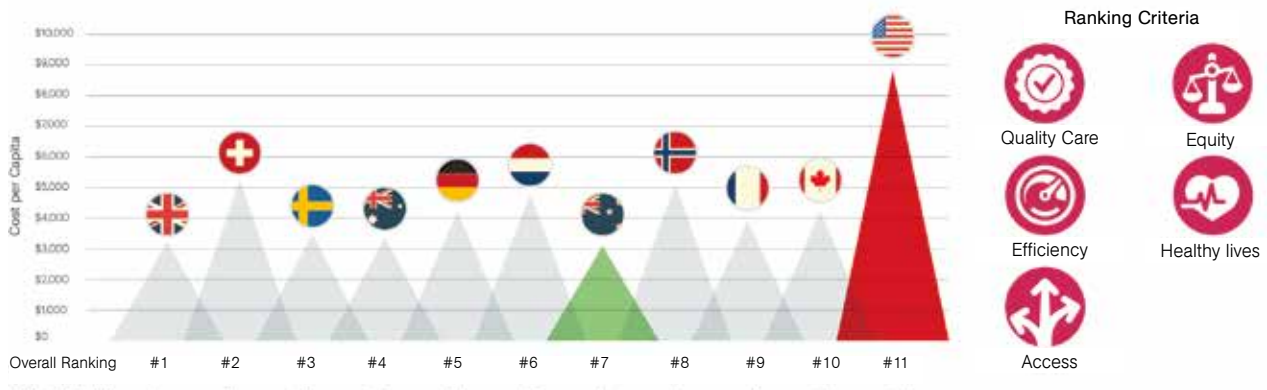


Fig. 8: Rising Healthcare Costs. / Source: Commonwealth Fund & CADRE 2015.

Care coordination

According to the AHRQ, “care coordination involves deliberately organizing patient care activities and sharing information among all of the participants concerned with a patient’s care to achieve safer and more effective care (figure 9). This means that the patient’s needs and preferences are known ahead of time and communicated at the right time to the right people, and that this information is used to provide safe, appropriate, and effective care to the patient”.

AHRQ proposes two ways of achieving coordinated care: Using broad approaches that are commonly used to improve health care delivery and using specific care coordination activities³.

This has strong implications for healthcare design because the healthcare delivery space must be considered a workspace that is conducive to care coordination. New trends in the healthcare workplace have been observed that include open office spaces for the care team to come together, touchdown and hoteling spaces to facilitate conversations, and emphasis on the consult space between patients and staff members to have better conversations.

Examples of broad care coordination approaches include:

- Teamwork.
- Care management.
- Medication management.
- Health information technology.
- Patient-centered medical home.

Examples of specific care coordination activities include:

- Establishing accountability and agreeing on responsibility.
- Communicating/sharing knowledge.
- Helping with transitions of care.
- Assessing patient needs and goals.
- Creating a proactive care plan.
- Monitoring and follow up, including responding to changes in patients’ needs.
- Supporting patients’ self-management goals.
- Linking to community resources.
- Working to align resources with patient and population needs.



Fig. 9: Care co-ordination. / Source: (CADRE, 2015) & Improving Chronic Illness Care².

Evidence Support

- Care coordination is particularly critical for patients with chronic conditions and in the context of an aging population⁴.
- Dysfunctional nurse-physician communication has been linked to medication errors, patient injuries and patient death⁵.
- Studies in non-healthcare settings show that proximity among employees and visual contact affect the pattern of communication networks and the probability of communication⁶.
- Presence of consult areas improves interpersonal communication⁷.

Facility Implications

Open Office (figure 10): Getting physicians, case managers and other health professionals out of their individual offices to an open plan so they can connect with each other. This fosters collaboration between diverse care teams through informal work areas within ambulatory clinics. The Duke Primary Care Clinic prototype was designed to include Huddle Rooms, semi-enclosed areas within the work core for coordination meetings between staff members. The space allows all members of a patient’s care team to collaborate on a care plan.

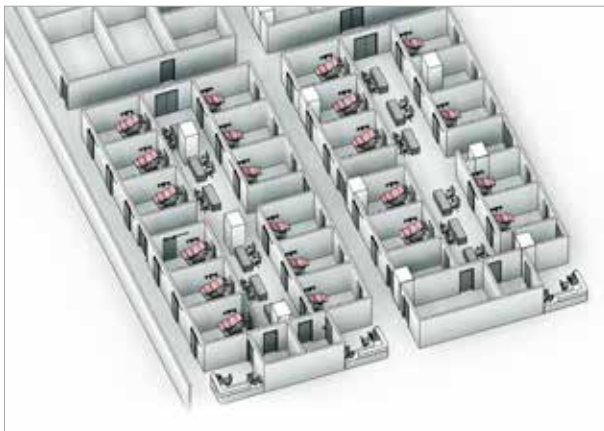
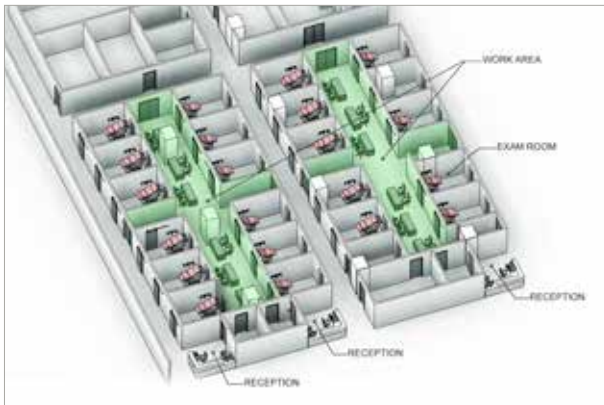


Fig. 10: Macau Island Hospital Outpatient Clinics.

Hoteling Spaces

These flexible spaces are favored as practice shifts from singular physician practices to multispecialty practices, providing unassigned spaces that can be used as needed by different team members.

Touchdown Areas

These areas provide the opportunity of impromptu information exchanges, in response to the increased level of communication between care team staff that is the cornerstone of ACOs and PCMHs. The

Duke Primary Care Clinic prototype includes several areas within the work core where staff members can quickly coordinate care; they included transaction-height counters at workstations and standing desk space available for quick two-person meetings.

Proximity Across Specialties

Locating specialties close together encourage interdisciplinary collaboration. The rise of multispecialty ambulatory care centers (MACCs) supports this trend.

On-Stage/Off-Stage

This is a clinic module borrowed from Disney practice. The on-stage areas include space for the public, and the off-stage is reserved for the care team. The use of double doors in exam rooms is an effective use of the practice, as it minimized congestion at the front of the clinic improves privacy and reduces noise levels in the clinic⁸.

Case Study: Macau Island Hospital

With relevance to the above consideration in clinical care team design and planning, similar concepts are adopted at the new Macau Island Hospital outpatient clinic department in Macau, SAR.

Prototypical Primary Care Clinic

Each primary care pod includes private exam rooms, consult room, private patient toilet, shared meds alcove, POC alcoves, physician dictation/ huddle areas and clinical work stations for teaming between every three exam rooms. Each pod was organized operationally to support physicians and a dedicated clinical support station for preparation and consultation between patients. The on-stage / off-stage concept is intended to allow for the public realm to be designed with a hospitality character, while keeping conveniently located clinical work areas hidden from public view. The design should assist in helping to reduce patient stress while allowing for private clinical work and collaboration areas. The Physician Pod is designed as a prototypical module, that could be combined in different arrangements depending of patient census and specific clinical practice needs. Each module is a kit of spaces that can be standardized within themselves and within the pod.

Prototypical Exam Room

A prototypical exam room was developed to provide direct access from the off-stage clinical support core,

while allowing patients to circulate into the exam room from the public realm without crossing clinical work areas. The exam rooms were designed with the intent that the majority of the care should occur within the room and as much care as possible should be brought to the patient. The design accommodates direct access to the clinical care team work area and provides for family support zones, patient care zones and care giver work zones within the 120 sf exam room footprint. A modular systems approach was applied to the clinical sink and work area allowing for a flexible workstation to be used by the care giver to document with the patient in multiple zones of the exam room.

NEURO-ARCHITECTURE

Creating a responsive environment for the aging population:

According to United Nations, the Asia-Pacific region is currently home to over half of the world's elderly population. The unprecedented pace of population ageing is primarily due to the tremendous improvements in life expectancy combined with falling fertility rates in the Asia-Pacific region. The number of older persons in the region is expected to triple from 438 million in 2010 to more than 1.26 billion by 2050. Projections from the United Nations Population Division show the proportion of seniors aged 65 and older will surpass the proportion of children (aged 0-15) in South Korea, Thailand, and China by 2030. Vietnam and Malaysia, meanwhile, will cross this threshold by 2040 and 2050 respectively.

“Silver tsunami” is a term often used in the past decade to describe the rapid increase of people over the age of 60 as compared to the overall population in Western countries, but only recently has the term been heard more and more often throughout Asia.

This trend has created a rising demand for healthcare services for the ageing population, prompting both the public and private sectors in countries across the region to massively expand healthcare and healthcare technology infrastructure. With enormous investment in building new healthcare facilities and expanding or updating existing facilities across Asia, hospital asset owners are constantly looking for innovative ways to design health facilities to meet the needs of an ageing/increasingly urban and demanding population. Health facilities now need to be modern, comfortable, aesthetic, efficient, safe and accessible. These characteristics demand huge investment not only into new developments but also in renovating and retrofitting existing facilities.

Neuro-architecture is an emerging field. Understanding the aging brain and the impact of aging on sensory systems is key to developing responsive environments for the aging population. This paper will look at cutting-edge research in the field of neuroscience and psycho-physiology and translate the research findings into design and architectural language that can be widely applied, thereby translating our “design response” that goes beyond the functional and the aesthetic, to the “sensesthetic.”

Aging is characterized by many changes that are reflected in the body, the various sensory systems, and most critically, the brain itself. As the brain ages there are fundamental changes which include changes in the prefrontal cortex (responsible for key cognitive functions) and the hippocampus (responsible for memory and emotional processing) (Figure 11). The changes in the neurons and neurotransmitters, blood flow, and development of new cells, reflects in the ability to learn new things, remember names, perform complex tasks of attention etc.



Fig. 11: The prefrontal cortex and the hippocampus

However the brain, which is inherently plastic, compensates for its reduced ability in some areas by increasing abilities in others. Research study results suggest that low-performing older adults recruited a similar network as young adults but used it inefficiently, whereas high-performing older adults counteracted age-related neural decline through a plastic reorganization of neurocognitive networks. This ability for the brain to adapt and cope depends on lifestyle, overall health, environment and genetics.

As designers we focus on the environment – however – it is important to remember that as the brain is changing, there are simultaneous changes in the sensory systems: hearing (hearing loss, change in equilibrium), vision (sharpness, focus, toleration for glare,

differentiation between colors, peripheral vision), smell and taste (atrophy in taste buds, reduced smell/taste perception), and touch (change in sensation and sensory thresholds). This implies that if we want to create environments for aging that promote a healthy brain- and look at Neuroarchitecture as a field, our “design response” must go beyond the functional and the aesthetic, to the “senssthetic”.

All senses can be affected by aging, but hearing and vision are most affected.

VISUAL CHALLENGES

- There is an inability amongst older people to tolerate glare. Glare such as from a shiny floor in a sunlit room can make it difficult to get around indoors.
- One may have trouble adapting to darkness or bright light

VISUAL SOLUTIONS

- As one ages, using warm contrasting colors (yellow, orange, and red) can improve the ability to see.
- Keeping a red light on in darkened rooms, such as the hallway or bathroom, makes it easier to see than using a regular night light.

AUDITORY AND MOTOR BALANCE CHALLENGES

- Our ears have two jobs. One is hearing and the other is maintaining balance. As we age, structures inside the ear start to change and their functions decline. Our ability to pick up sounds decreases.
- We may also have problems maintaining our balance as we sit, stand and walk. Motor performance deficits for older adults appear to be due to dysfunction of the central and peripheral nervous systems as well as the neuromuscular system. Motor performance deficits include coordination difficulty (Seidler et al., 2002), increased variability of movement (Contreras-Vidal et al., 1998; Darling et al., 1989), slowing of movement (Diggles-Buckles, 1993), and difficulties with balance and gait (Tang & Woollacott, 1996) in comparison to young adults.
- Gait and balance problems are of particular interest as falls are a major source of injury and morbidity in older adults: 20–30% of older adults who fall suffer moderate to severe injuries that limit mobility and reduce quality of life (Alexander et al., 1992). Older adults exhibit greater spatial and temporal movement variability, resulting in less consistent actions as compared to young adults (Contreras-Vidal et al., 1998; Cooke et al., 1989; Darling et al., 1989).

RISK FOR FALLS

- Approximately one-third of community-dwelling older adults fall each year; the rate is doubled in senior group dwellings (Gillespie et al., 2001; Jensen et al., 2002). Even without injury, falls may cause a loss of self-confidence and result in reduced active behavior and increased dependency among older adults (Gallagher et al., 2001). Falls have been identified by the elderly as the most significant barrier to active behavior (Wilcox et al., 2003).
- According to a United Nations report, in the South-East Asia Region the incidence of falls amongst older adults varied from 31% in China, to 20% in Japan. The economic impact of falls is critical to family, community, and society. Healthcare impacts and costs of falls in older age are significantly increasing all over the world. Fall-incurred costs are categorized into two aspects: Direct costs encompass health care costs such as medications and adequate services e.g. health-care-provider consultations in treatment and rehabilitation. Indirect costs are societal productivity losses of activities in which individuals or family care givers would have involved if he/she had not sustain fall-related injuries e.g. lost income.

DESIGN SOLUTIONS FOR FALL PREVENTION

- Clear circulation/corridor systems should be applied in the building for older adults, as some of them may have memory impairment or suffer mental problems.
- Different function zones should be separated and applied with distinct design factors (e.g., colors and styles) to aid in place recognition.
- Corridors in the building for elderly people are suggested to be short, with uninterrupted visual destinations or environmental cues; short and clear corridors has been found to be more navigable for older adults than long corridors (AIA, 1985; Brawley, 1992; Goldsmith, 1996; Passini et al., 2000).
- The location of utility/service rooms in residences for older adults should receive special attention. The laundry room should be located on the bedroom or bathroom level of the residence (Haslam et al., 2001). The location of a storage room may depend on its function.
- The usefulness of grab bars (figure 12) for fall prevention has been recognized (Sattin et al., 1998). In addition, door handles or push bars, instead of knobs, should be installed in residences for older adults (Gilderbloom & Markham, 1996).
- Irregular floor surfaces should be avoided and hard-surface flooring are recommended as it



Fig. 12: Grab bars and appropriate finishes. Source: HKS, Inc.

improves standing balance and postural stability (Redfern et al., 1997; Thies et al., 2005).

- High-density and low-pile commercial-grade carpeting has been suggested as a safe flooring material for healthy older adults (Dickinson et al., 2002).
- The bathroom has been identified by older adults and researchers as the most common site of environmental hazards (Carter et al., 1997; Huang, 2005). Besides slip-resistant floor surfaces, sliding glass shower doors should be avoided (Murphy et al., 2006). Walk-in shower stalls or bathtubs with rails, raised toilet seats, and wide clearances have been suggested for elderly users (Jenkins et al., 1997; Percival, 2002).
- Regarding the kitchen design, adequate spaces facilitating different eating routines are preferred (Percival, 2002). Square-shaped kitchens may seem more spacious, compared to linear-shaped kitchens. Boschetti (2002) recommended an L-shape (figure 13) layout for kitchens used by the elderly, as it affords a corner to lean against. Installing carefully designed stair handrails for stability is necessary; an appropriate height and a proper sec-



Fig. 13: L shaped kitchens for elderly.

tion size of the handrails should be applied. Closed risers, consistent riser heights, appropriate short riser and long tread, coarser tread surface textures are some of the key strategies for fall prevention in staircases.

- An elevator or stair lift may promote independence when an individual becomes too disabled to use stairs, (Gilderbloom & Markham, 1996). However, Simoneau et al. (1999) found changes in stable visual anchors, as when exiting an elevator cage, may create risks for falls among older adults. This risk may be exacerbated by dim lighting in the elevator cage.
- Lack of illumination appears to be related to poor postural stability among older adults and may induce risks for falls (Brooke-Wavell et al., 2002; De Lepeleire et al., 2007). Furthermore, changes in light levels should be smooth, as older adults need more time to adapt to changes in light levels than younger adults (Brabyn et al., 2000).
- Visual spatial cues can help older adults with declining memory recognize places and respond to the surroundings. Sundermier, et al. (1996) noted that specially designed elements in the space can be used as cues by older adults while moving around and be helpful to prevent falls. sizes the edges of spaces and help older adults distinguish features of the environment.
- Research by Perritt (2005) on carpet patterns showed that that high contrasting patterns were associated with more incidents (stumbles, reaching for handrail, veering, purposeful stepping, pausing, stopping) than carpeting with low color contrast patterns. Bonato and Bubka (2011) found that viewing high contrast static patterns (black and white squares laid out in regular patterns on a rug) can induce motion sickness. In a recent correlation study by Calkins (2012), it was found that vinyl flooring with medium size pattern (1"- 6") was associated with greater falls than no pattern, small pattern (6"). These few studies suggest that floor glare and pattern may contribute to falls. However, the underlying relationship, and ideal condition for each, demands more research."

TACTILE CHALLENGES

- With aging, you may have reduced or changed sensations. These changes can be related to decreased blood flow to the nerve endings or to the spinal cord or brain. The spinal cord transmits nerve signals and the brain interprets the signals.
- After age 50, many people have reduced sensitivity to pain. Or you may feel and recognize



Fig. 14: Avoid reflective surfaces.

pain, but it does not bother you. For example, when you are injured, you may not know how severe the injury is because the pain does not trouble you. Older persons can develop an increased sensitivity to light touch because of thinner skin. Avoid reflective surfaces, Utilize Materials with texture (figure 14).

MULTI-SENSORY DESIGN SOLUTIONS

- It also appears that additional brain regions can be activated in older adults during cognitive tasks, such as taking a memory test. Researchers do not fully understand why this happens, but one idea is that the brain engages mechanisms to compensate for difficulties that certain regions may be having. For example, the brain may recruit alternate brain networks in order to perform a task. Multisensory integration becomes more important during aging as it helps to counteract the often-destructive consequences of unisensory deterioration. Mozolic et al. (2012).

AUDITORY AND VISUAL SOLUTIONS

- Use vision and sounds to direct:
- A “Sensthetic Model” – is a conceptual tool to think “across” modalities that can help professionals and students to design, study or experience sensory environments. It is a step beyond the aesthetics of appearance, towards a Sensthetics of Experience. (Nanda, Lee, & Wang, 2015).

Case Study: Signage as Visual Solution, Nature as Medicine

In large buildings, especially in hospital when we are not at our most alert state, finding our way around can boggle the most organized minds.

At Macau Island Hospital, we drew from the flora and nature that surround the city (figure 14), and applied them to a well thought out “way-finding” system (figure 15). We used yellows and reds which stimulate and are good for dining and social areas on the patient floor. As one ages, it gets harder to tell apart blues and greens than it is to tell apart reds and yellows.

Regarding interior colors, unsaturated and washed-out colors will be avoided in the environments for older adults, as it is difficult for them to discriminate these colors and color confusion may result in falls. In addition, an appropriate contrast between colors of the wall and the floor, and floor surfaces at different levels emphasizes the edges of spaces and help older adults distinguish features of the environment at the new Macau Island Hospital.



Fig. 14: Inspiration from flora and nature that surrounds the city.



Fig. 15: "Way-finding" system.

LEAN PROCESS DESIGN

Lean is a production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination. Working from the perspective of the customer who consumes a product or service, “value” is defined as any action or process that a customer would be willing to pay for. A lean organization understands customer value and focuses its key processes to continuously increase it. The ultimate goal is to provide perfect value to the customer through a perfect value creation process that has zero waste.

To accomplish this, lean thinking changes the focus of management from optimizing separate technologies, assets, and vertical departments to optimizing the flow of products and services through entire value streams that flow horizontally across technologies, assets, and departments to customers.

Eliminating waste along entire value streams, instead of at isolated points, creates processes that need less human effort, less space, less capital, and less time to make products and services at far less costs and with much fewer defects, compared with traditional business systems. Information management becomes much simpler and more accurate.

Lean applies in every business and every process. It is not a tactic or a cost reduction program, but a way of thinking and acting for an entire organization.

“All we are doing is looking at the time line, from the moment the customer gives us an order to the point when we collect the cash. And we are reducing the time line by reducing the non-value adding wastes.” Taiichi Ohno

The principles of Lean explain that every activity, in every business, started by people can generate more or less waste. It exists in all processes and it can be seen in various ways. Many forms of waste are obvious, but others are not easy to see without especially looking for them. It may be hard to identify it sometimes. In Japanese, waste is categorized into three different words; Muda (unproductive), Mura (inconsistent) and Muri (unreasonable).

Waste in Design and Construction

The Lean Construction Journal in a 2009 white paper pegs the ratio of non-value-added or wasteful activities in a typical construction project at 55% to 65%. While it is easy to pick on our construction friends when much of their waste is easy to see in terms of materials, motion and transportations on a interpretation, etc., the design team members too own a fair share of that percentage.

We need to think about every task that you do in terms of, is this value added to the project, and would the customer pay for this? We must ask team members what the tasks are to deliver the customer the value they request and try to produce only those tasks.

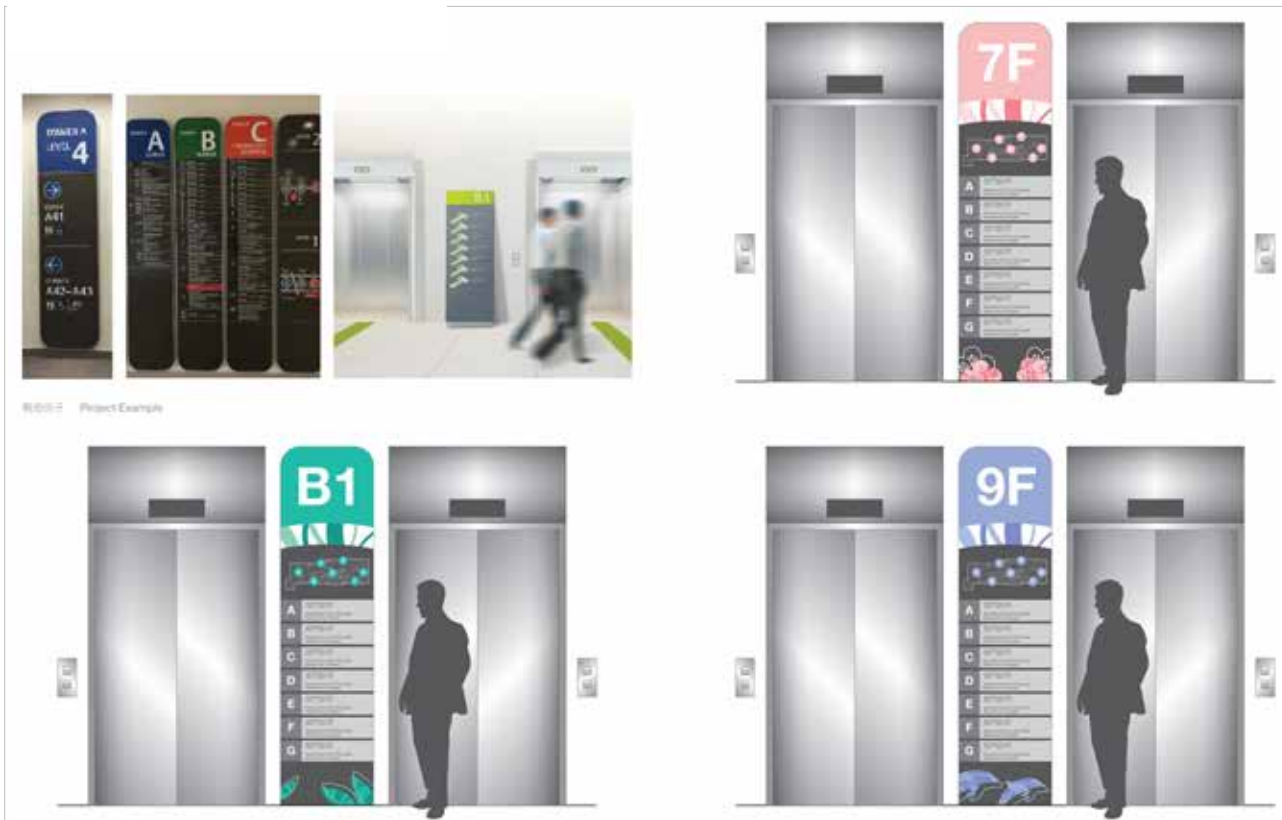


Fig. 16: Lift lobby signage

Macau Island Hospital LEAN Process Design

Real-time mock-ups

Many architectural processes involve a full-scale mock-up, usually in a warehouse or other large space on campus where users visit the mock-up and offer comments. While these mock-ups tend to be very helpful, one lean tool that can be even more helpful is the real-time mock-up (figure 16).

At Macau Island Hospital, mock-ups for typical patient room, typical ICU room, OR, typical exam room were built. This gave a more realistic evaluation of how the space would be used and nurses were able to start implementing processes and using the equipment planned for the new unit ahead of time.

Process Mapping

A clear departure from the traditional design approach, Process Mapping takes an in-depth look at existing and future hospital processes (figure 17). The teams examine each operational process from the point of view of the patient, staff and family members, highlighting value-added activities and non-value-added activities through observation and process mapping of the current state of operations. Each step

“The most dangerous kind of waste is the waste we do not recognize.”

Shigeo Shingo

in a process is mapped diagrammatically with additional layers of analysis, such as the time it takes to complete the task and the value of that task, and then added to the diagram. Once the current state maps for each area are completed, unnecessary steps and problems are discovered and solutions are brainstormed to create future state maps showing how processes will be done more efficiently at the new facility. This phase differs from the traditional design approach in that there is considerable effort in the early phases gathering information, defining value and reviewing processes to inform the program and design effort. □



Fig. 17: Process Mapping for Macau Island Hospital

¹ K. Davis, K. Stremikis D. Squires, C. Schoen (2014) *Mirror, Mirror on the Wall 2014. Update, How the Performance of the U.S. Health Care System Compares Internationally*, The Commonwealth Fund. Retrieved from http://www.commonwealthfund.org/-/media/files/publications/fund-report/2014/jun/1755_davis_mirror_mirror_2014.pdf. Accessed on April 8, 2015.

² *Improving Chronic Illness Care (2006–2015)*. The Chronic Care Model. Retrieved from http://www.improvingchroniccare.org/index.php?p=The_Chronic_CareModel&s=2. Accessed on April 8, 2015.

³ *Care Co-ordination*. (2014, October). The Agency for Healthcare Research and Quality, Rockville, MD. Retrieved from <http://www.ahrq.gov/professionals/prevention-chronic-care/improve/coordination/index.html>. Accessed on April 8, 2015

⁴ Hofmarcher, M. M., H. Oxley and E. Rusticelli (2007), “Improved Health System Performance through better Care Coordination”, OECD Health Working Papers, No. 30, OECD Publishing.

⁵ Arford, P.H. (2005). Nurse-physician communication: an organizational accountability. *Nursing economics* 23 (2), 72–77.

⁶ Allen, T.J. (1997). *Architecture and communication among product development engineers*, WP Sloan School of Management, Massachusetts Institute of Technology. Retrieved from: <https://dspace.mit.edu/bitstream/handle/1721.1/2682/SWP-3983-38485315.pdf?sequence=1>. Accessed on April 8, 2015.

⁷ Ajiboye, F., Dong, F., Moore, J., Kallail, K. J., & Baughman, A. (2015). *Effects of Revised Consultation Room Design on Patient-Physician Communication*. Retrieved from: <http://her.sagepub.com/content/8/2/8.abstract>. Accessed on April 8, 2015.

⁸ The Advisory Board Company (2012/2014). *The Patient Centred Ambulatory Facility*, Facility Planning Forum, Washington D.C.

Bibliography

CADRE, U. N. (2015). *Clinic 20XX-Designing for an ever-changing present*.

Nanda, U., Lee, A., & Wang, Z. (2015). *The Neuroarchitecture of Aging and the “Synthetic” Response*. *Environments for Ageing*. Baltimore.



Angela Lee



Principal and Managing Director, Asia Pacific

Successful design is the result of the harmonious relationship and balance between patient and user experience, form and function, budget and schedule, sustainability and sound business principles.” Angela’s 21 years of experience encompasses LEED and JCI Accredited medical projects ranging in size from 10,000 to 3.5 million square feet and bed counts from 30 to 1,650 beds, in the US and internationally. Her specialties include Healthcare Architecture and Healthcare Planning –she develops innovative, quality healthcare design solutions that meet the client’s vision and embraces the challenges and complexities of healthcare design and creates quality solutions. Her projects range from 100-bed children’s hospitals to 1,650-bed greenfield hospitals. She has worked with prototype healthcare facilities, healthcare guideline and references.

Kenneth Webb



Associate Principal, HKS Inc.

Kenneth is a senior planning and design architect with 16 years of experience focusing on conceptual design, master planning, schematic design and design development. His expertise includes working closely with medical professionals, physicians and consultants in planning state-of-the-art healthcare facilities. Kenneth leads design teams to develop innovative solutions that meet the client’s needs without sacrificing functional and operational efficiencies.

Andrew Jaeger



Vice President, HKS Inc.

Andrew contributes 16 years of experience dedicated solely to the planning, programming, design and integration of state-of-the-art medical technologies into the healthcare environment. His experience in healthcare design encompasses all hospital clinical areas and service lines including inpatient care units, surgical suites, pharmacies, diagnostic imaging and radiation and oncology. However, it’s Andrew’s in-depth expertise in clinical laboratory operations and design that clients truly respect and appreciate the most about him. Utilizing his extensive expertise in laboratory design and processes, Andrew provides clients with state-of-the-art, laboratory design solutions that enable and promote Lean/ Six Sigma lab processes and operations.



2

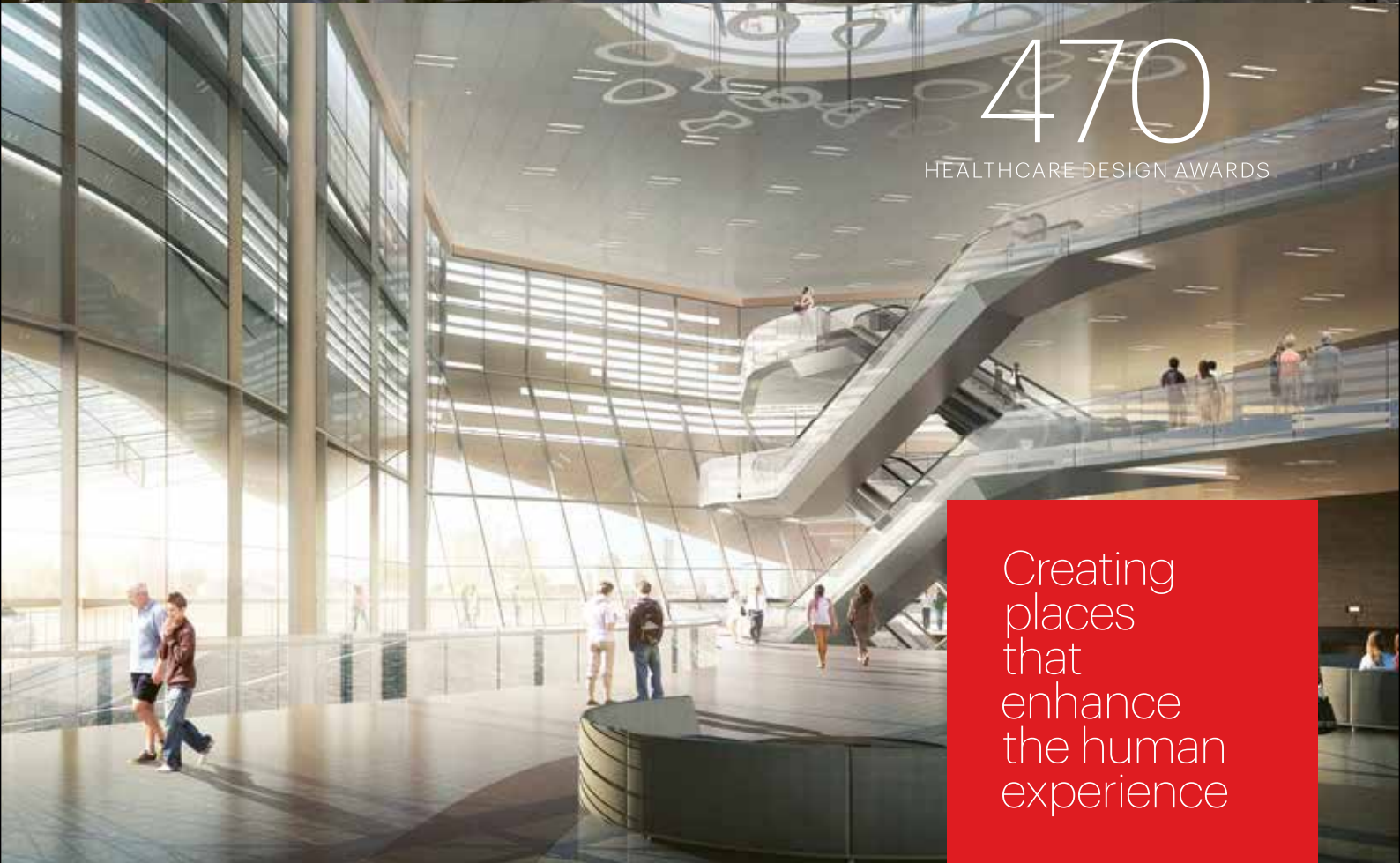
RANKED THE SECOND-LARGEST
HEALTHCARE DESIGN FIRM IN THE WORLD

27

27 OFFICES WORLDWIDE

90

PERCENT OF OUR HEALTHCARE BUSINESS
IS REPEAT CUSTOMERS



470

HEALTHCARE DESIGN AWARDS

Creating
places
that
enhance
the human
experience

HKS

WWW.HKSINC.COM

Salutogenic Healthcare Services as part of a **Women's Health Center:**

Wuxi Taihu Ecological New Town Integrated Medicine Clinic

Yu Xia Qiu, Richard Sprow, Xiaodan Luo

Healthcare in China is deeply connected to the importance of health and wellness activities and preventative care. Chinese culture is based on many ideas of mind/body awareness and the rebalancing of life forces, and a traditional idea is that a carefully designed setting can assist this process and help the patient and their family to think about natural forces; the facility design itself can help to increase the benefits of the health services offered.

The Wuxi Ecological New Town healthcare project on scenic Tai Lake combines a women's hospital, ambulatory care center and recovery centers for maternity care and rehabilitation with extensive wellness/fitness, and medical checkup services. Wuxi Taihu will be a destination for health recovery and improvement as well as for medical

care. The development and design team has created an innovative and welcoming Integrated Medicine center as a separate program which incorporates a range of assessment, diagnostic, and treatment services into an outpatient experience. With a limited amount of space to work with, the team has planned:



Stages



The unique design meets the technical and Chinese code requirements for healthcare while providing a calm, meditative atmosphere. Careful attention to functional adjacencies and technical room criteria and medical equipment planning is balanced with small private waiting and patient areas, sensitive lighting, and use of natural materials and landscape elements. The availability of multi-function diagnostic testing and treatment is an integral part of the center's checkup and wellness packages where the goal is comprehensive health and lifestyle improvement.

The project development leader and the medical planning team will discuss the translation of this traditional focus on health-giving buildings into a modern center with current technology.

Wuxi Taihu New Town Integrated Medicine Clinic Project

The Wuxi Taihu New Town health center is a product of Changjiang Runfa Group Ltd which was founded by Dr. Yu Xia Qiu, MD, a specialist in obstetric care, to develop improved women's health services in the rapidly growing Wuxi area. The project design inspiration is to integrate Chinese elements, Wuxi regional elements, sustainable design, green landscaping, humanity, and express the feeling of an advanced, high end center for health assessment and treatment which is practical, economical and beautiful, aiming to be the iconic building of the new Wuxi health center.

Evolving Private Healthcare Services in China

The healthcare environment in China is changing rapidly, as the central government encourages the participation of private investors and the development of private hospitals and health care systems to provide additional capacity to serve the rapidly growing urban population. Entrepreneurs with experience in other areas of development are now teaming with international planners and local design teams to create a new generation of advanced facilities on a very short schedule. Planning a large hospital to incorporate current technology, tailored to meet the special code requirements and cultural practices of China, is a special challenge and needs a closely integrated team.

For the planned Wuxi Women's and Children's Hospital, the development team has proposed a 600-bed, 180,000 SM (1.9 million SF) new medical complex. Planned for a previously undeveloped site in the new city, bounded by a water channel, the overall proj-

ect includes an Ambulatory Care Center, a Women's Cancer Center, and a full range of inpatient hospital care for Obstetrics, Women's Health, Rehabilitation, and ICU/ NICU patients, as well as below-ground parking for 2,000 cars. As part of the new Ecological City development, this iconic project needs to meet China Green Star sustainability requirements and to be developed in one step, rather than being phased in over a longer development period. The team of Owner, Design Architect, and local Design Institute developed a master plan which responded to competing design requirements:

- **Clear, iconic overall design** to represent a facility for women and children.
- **Positive, inviting environment** for maternity care and women's health focused on wellness, not illness.
- **Efficient and flexible planning** with compact circulation and clear patient and staff flow.
- **Family-centered design** with ample space for visitors and care givers.
- **Design to meet Chinese environmental** and sustainable design requirements for natural light and ventilation.
- **Digital hospital technology** to support Lean Design of care.
- **Flexible and adaptable** over the long term and able to add beds as needed.

As private developers create the next wave of health-care projects to meet rising demand, this project is a clear example of the issues in changing health care delivery in China. While China offers a national health care program for citizens, less than 20% of the population is served by this limited program, and about half of current healthcare costs are paid privately. The current system of large public hospitals is strongly oriented to inpatient care and hospital-based outpatient care, with no economic incentives to create a Western model of family practice physicians and off-site ambulatory care centers.

Chinese consumers expect to spend a lot of time at large scale hospital clinics, and average inpatient length of stay is about 11 days. The challenge for the evolving public and private healthcare system is to not just add more beds and more clinics but to also incorporate innovations in care to reduce length of stay and to increase overall productivity of the system. Shortages of physicians and nurses and trained hospital administrators complicates this effort to develop new hybrid types of facilities to meet the needs of specific patient populations.

One area of particular interest to Chinese healthcare users is the idea of “check-up centers” which offer a range of integrated medicine services for wellness and health prevention. The historic cultural interest in Traditional Chinese Medicine, usually non-interventional procedures such as acupuncture, herbal medications, cupping, and massage therapy is coupled to preferred ideas from Western medicine such as drug therapy, saline solution intravenous therapy, laboratory testing and diagnostic imaging to create a package of services which is attractive to private pay patients and often provided as a perquisite or benefit to employee groups.



Site Wuxi

The project site is located in the developing Wuxi Ecological New Town in the Tai Lake district, 2.5 kilometers away from the new Wuxi government center, one of the new ‘Four Towns’ in the Wuxi area. The site is bordered by a branch of the Yangmuqiao River and is close to the scenic lake and nearby Changguangxi Wetland protected area. The wetland was part of a canal dug during the Three Kingdoms period (AD 220–280) connecting Li Lake in the north and Tai Lake in the south, but it had become seriously polluted by industrial wastewater over many decades. Now the wetland is restored as a 300-hectare park with hundreds of varieties of plants, fish and birds.

This Low Carbon Ecological Town Demonstration is a joint project between China and Sweden, and a landmark project supported by the central government. This site is about 120 kilometers west of Shanghai, a travel distance of less than two hours by high speed rail or by motorway, in an area noted for its new high technology and optical and electrical industry, and its large scenic lake.

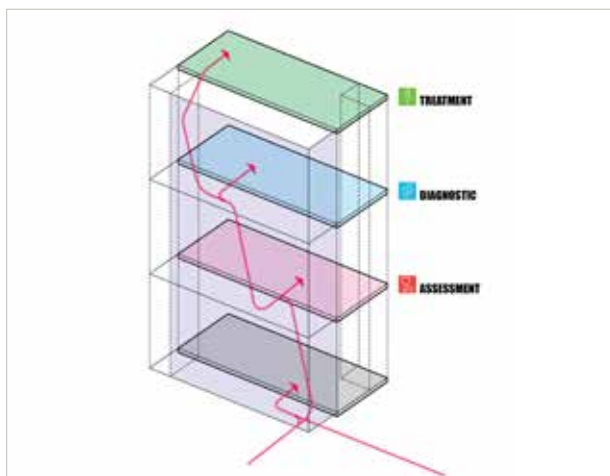
Clinic Functions and Goals

Consumers in China are very aware of the need for improved health care services, and current services such as hospital-based ambulatory care centers and neighborhood health clinics generally see very large volumes of patients, often 5,000 to 10,000 per day in a single large hospital-based clinic. The central government provides a basic level of health care services to all Chinese citizens, but there is a continuing shortage of doctors, nurses, and other health care providers which causes limited availability of appointments, very short visit times, and a lack of personalized care. While there is great interest in Traditional Chinese Medicine (TCM) services, consumers are also very interested in drug therapy and infusion therapy and many parts of the health care system depend on revenues from these products and services.

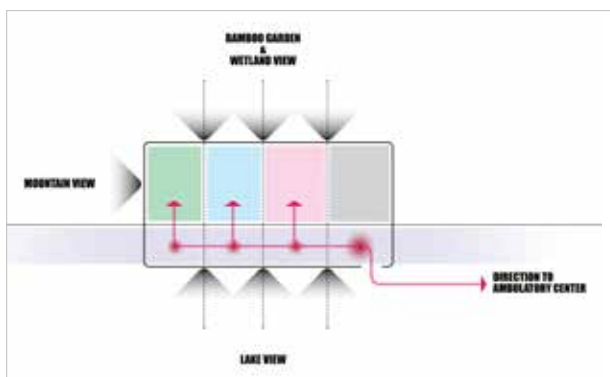
The Wuxi Taihu New Town Integrated Medicine Clinic invites women to take a more active and long term view of their personal health, with a focus on assessment, recovery, wellness, and health prevention which will be a foundation of long term health. In addition to an adjacent Ambulatory Care Center linked to the Women’s Hospital, the health center also includes this smaller-scale Integrated Medicine Checkup Center facility to offer personal healthcare on a proactive basis. Each clinic patient will receive a customized package of clinic services in three basic areas:

- **Health Assessment:** To establish a starting benchmark, patients will receive comprehensive checkup services, with medical exams, physician consultation, and specialized counseling such as nourishment, weight management, mental health, stress management, and wellness and fitness guidance and personal training
- **Diagnostic Services:** As part of the health checkup, patients may undergo genetic DNA screening, clinical lab testing, EKG testing, or imaging studies such as MRI, cardiac CT, PET CT, Mammography, Ultrasound, Stress Testing, and Bone Densitometry. All of these services are provided within the clinic, with no need to go to the adjacent Ambulatory Care or Hospital buildings.
- **Treatment Services:** After their check up and assessment of needs, patients will have access during their stay to a variety of treatment modalities on site, including Traditional Chinese Medicine, Anti-Aging services, Physical Therapy, Infusion Therapy, Injections, Pharmacy services, and weight loss programs or customized exercise and spa programs.

“The design concept is to express layers of openness and privacy...”



Floor circulation



Floor circulation



Mode

Design Concept

To accommodate this wide range of services which integrate Western, Chinese, and alternative health-care, the clinic has a space of about 3,000 SM (33,000 SF) on four floors of the Check Up building, which is the corner of the Wuxi Taihu Ecological New Town health center. A vehicle drop off is adjacent to the clinic space and parking is available in the basement level. The Clinic looks out onto a Bamboo Garden and the landscaped Health Center grounds beyond.

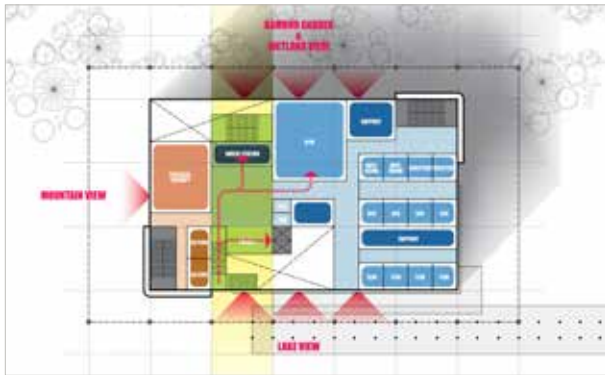
The goal of the clinic design, developed by Perkins Eastman Architects of Shanghai, is a unique design to meet both the technical and Chinese code requirements for healthcare while reflecting the calm, meditative atmosphere of a health resort. Careful attention to functional adjacencies and technical room criteria and medical equipment planning is balanced with small private waiting and patient areas, sensitive lighting, and use of natural materials and landscape elements. The availability of multi-function diagnostic testing and treatment is an integral part of the outpatient checkup and wellness packages where the goal is comprehensive health and lifestyle improvement.

The Integrated Medicine Center takes advantage of its highly visible location to present a distinct appearance which harmonizes with the large hospital and clinic buildings behind it but clearly expresses a different level of care and a different feeling. This smaller, 4 level building is very different from the large 7 story Ambulatory Care Center and the 12 and 15 story hospital buildings on the same overall site. The design reflects the lower patient volume and the resulting higher level of personal attention, with a capacity of about 100 daily patients, as compared to the 2,000 patients and families who will use the Ambulatory Care building in a typical day.

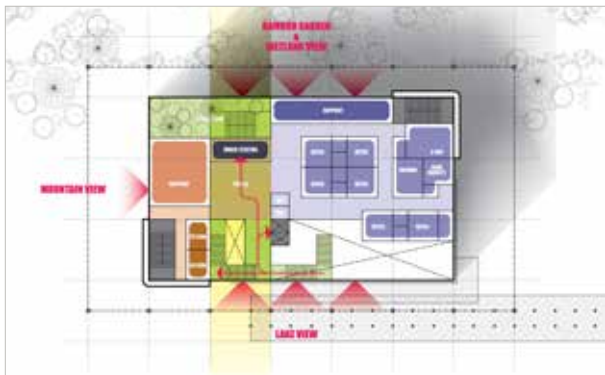
The design concept is to express layers of openness and privacy, as a contrast with the more closed forms of the higher capacity institutional buildings, and to reinforce that difference by the use of similar but different materials.

Design Process and Features

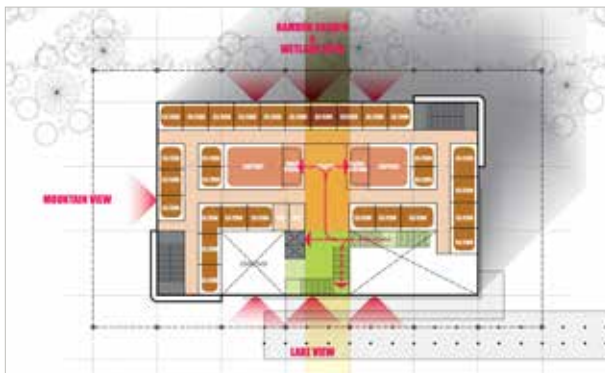
The clinic design was developed in a series of working sessions with client project leaders, and reviewed at key stages by to insure it reflected the spirit and the design references of the larger project. The team first developed and reviewed a space program to define at a room by room level the components needed to provide the planned services and to confirm the design fit within a limited existing space. One of the key early decisions was to analyze patient flow into the



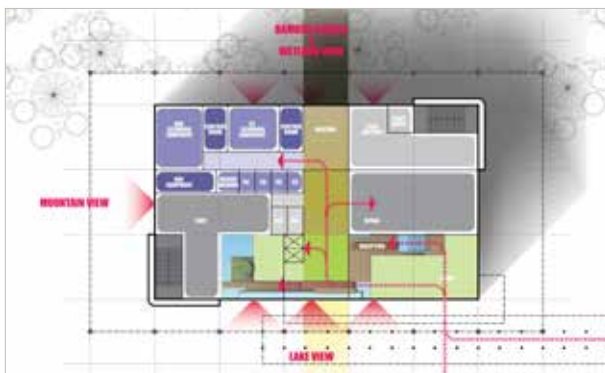
Plan 4th floor



Plan 3rd floor



Plan 2nd floor



Plan 1st floor

space and to locate each part of the program within the available blocks of space on four floors.

- **Treatment services** were located on the upper floors, to allow for flexible use and quick in and out by patients who will have recurring treatments or consultations and know where they are going, away from the crowd of new patients and family members at the ground floor.
- **Health assessment** functions, which will be a one-time event for each patient but the first step in their care, were assigned to a central location on the ground floor, allowing for easily visible reception and waiting, exterior views and direct access to the adjacent Bamboo Garden, and use of flexible exam/consult rooms. Because most patients will be accompanied by family members for the initial visit, the ground floor also includes visitor amenities such as the healthy café and public waiting around a water feature.
- **Diagnostic imaging services** which will be used in various ways by different types of patients were split between a ground floor wing, the most practical location for the heaviest equipment such as MRI and CT, and a second floor center for smaller functions such as Mammography, Digital X-ray and Ultrasound.

As part of the planning for Health Assessment services, the team has considered new ideas for typical Chinese Exam/Consult Rooms. Unlike Western practice where physicians typically move from room to room to examine and meet with patients, in China most physicians are full time hospital or clinic employees who are based in one combination exam/consultation/office rooms, where patients and families come to them. Most visits to doctors involve talking and consult with patient and family, but not necessarily a physical exam. The design team developed a modified version of this typical doctor's exam/consult/office room, but with built-in seating for family members, a motorized exam chair for the patient instead of an exam table, and a flexible mobile computer table to allow face-to-face doctor to family group discussions in a warm and inviting space, not a cold and clinical room.

With operable windows and a light shelf design, the rooms will have diffused natural light and access to natural ventilation. The specific layout of the room is based on clinical experience and considers the best location for the doctor in relationship to the exam table, and the best location of diagnostic equipment, supplies, and the hand-washing sink. A key point is to make all rooms the same, to support staff training around these procedures, rather than creating mirror-image opposite hand rooms to gain small efficiencies in plumbing layout.

Interior Design Approach

With basic locations of the three functional groups established, the design team identified several early goals:

- **FLEXIBILITY:** Whenever possible design spaces for multiple uses and changes in use. Health care facilities remain in use for many years, often as much as 50 years, so they need to be able to respond to changes in procedures as well as in technology. Rather than create an overly specific design, the goal is to provide rooms which have the correct size to change in use from exam to consultation to procedures, without making them too large.
- **FAMILIARITY:** Create unique and contemporary environments which will feel familiar to the patients, families and staff who use them. Health care patients, even in a wellness and health prevention setting, are uncertain and have some anxiety and start the process a bit on edge. Instead of a coldly institutional setting geared only to operational convenience, the goal is to use design cues which encourage patients and the family members who almost always come with them to relax and feel more at ease. The exam/consulting room design purposely does not include a large physician desk which immediately puts the patient in the position of being a less-powerful visitor. The new design puts the physician at a chair with a movable computer table, able to be part of the family circle for intimate discussions. Welcoming seating is provided for family members, all on the same level, while creating a privacy zone for patient exams as needed. Materials in the room include wood and fabrics and residential scale fittings, not all stainless steel and overly medical.
- **DURABILITY:** Plan for use of finish materials and furnishings which meet and exceed lifecycle expectations for healthcare facilities, which require more intensive cleaning methods and longer periods of use than other commercial or retail environments. Even while presenting a familiar appearance, healthcare interiors need to be fully cleanable with strong materials like bleach, so finishes and furnishings need to be chosen with care so that they will continue to look fresh and visibly clean. Where there is moving equipment, walls and corners needed to be unobtrusively protected from damage, knowing that repairs will seldom happen later.
- **BIOPHILIA PRINCIPLES:** Design based on how humans connect to the natural world, and embrace the 7 senses of *sight, taste, touch, sound, scent, motion, and balance*. Healthcare research shows



Stair



Stair



Café

that a stronger sense of a relationship with nature creates physical well-being for people, inspires creativity, and promotes positive social interactions. It can also reduce stress and mental fatigue and agitation, and create a stimulating environment which helps healing and recovery.

The goals of biophilic design include 10 key elements as part of the environment:

1. *Dynamic use of natural light*, with changing light through the day and natural light color balance. Prioritize availability of daylight in areas with the highest occupancy, such as waiting areas, corridors, exam/consulting rooms and offices.
2. *Provision for natural ventilation*, controlled by the occupants. Chinese building codes require operable windows in occupied areas, with a net open area equal to 20% of the window area in that space.
3. *Access to water* in terms of sound and pattern, even in very small elements. The sound of water is a natural form of white noise, and the movement of light off of water is something people are naturally attracted to.
4. *Sensory connections to nature*, to experience a change from man-made space. This can include irregular textures and materials, as a change from flat, consistent man-made surfaces.
5. *Elements of mystery and exploration*, which engage the mind and the senses. Humans are geared to move toward sources of light, so a hint of daylight around the next corner or at the end of a corridor encourages natural movement and engages the brain.
6. *Use of prospects, refuge and sense of scale*, to encourage movement through the space. Humans want to go to higher places to have a better view of their surroundings, and to be aware of possible shelter and to avoid large open areas. The scale of circulation areas should be proportionate to the volume of people to make them comfortable.
7. *Including natural forms* as a subtle reminder that health is a natural force. In addition to actual plants or natural materials, even the image of leaves or objects from nature makes the mental connection.
8. *Use of natural materials and patterns*, especially in places which can be touched and felt. People want to touch and experience their space, so

real wood at a touchable level can augment artificial materials, and being able to touch and experience warm wood or cool solid stone reinforces a subliminal feeling of a relationship with the natural world.

9. *Spontaneous interaction with nature*, to allow the experience to be slightly different each time. Water features and fish ponds offer this constant change, even in a casual encounter, so does a view of moving water like a lake or wetlands.
 10. *Use of local materials*, to encourage a subconscious sense of place and being connected to familiar things. The goal is to make users of a space feel naturally connected to it as part of the regional environment, not as a series of stage sets using distant materials. Interior and exterior materials and forms should have a natural harmony and rhythm.
- **SALUTOGENIC PRINCIPLES:** Beyond just these links to the natural world, a key goal of the Wuxi Clinic project as a health care setting is to use the design of the facility to encourage mental and physical health by offering engagement, activity, and clarity rather than the confusing, hard-edged and institutional environment which is typical of many healthcare facilities in China and the world. The Integrated Medicine Clinic is purposefully set apart from the higher-volume Ambulatory Care Center, with its thousands of daily visitors.

Its smaller scale, lower volume program is reflected in a welcoming lobby which offers clear circulation and choices to patients and families. The lobby separates circulation and waiting areas, with a clear visual link to the outdoor Bamboo Garden beyond, and an inviting open stair encouraging users to walk to the visible second floor space, where coffee and refreshment facilities have been located as an attraction, with access to the green roof terrace. The goal is that on entering the clinic, stress can be reduced and patients are reminded that services here are their conscious and voluntary step toward their own health.

Lobby spaces are high and filled with light that expresses natural circadian rhythms, from the cool daylight of the morning to the warmer afternoon sun from the west-facing windows. Interior plantings at large and small scales are combined with controlled water features which are planned for infection control while providing the sight and sound of water flow. Fish and moving water create changing variety for observers. The waiting areas offer seating



Suzhou Garden

under small trees, giving a sense of shelter, and a choice of the high-ceiling main space or the alternative protected feeling of seating under the lower balcony ceiling. The goal is to offer natural choices of activity and a positive bias toward movement and engagement in activities, not a large scale institutional waiting room.

At the upper floors, visible and inviting stairs are combined with the elevators to encourage walking as a clear alternative, and windows in the stairs with a garden view offer a surprise benefit to users. The building design encourages users to move naturally to higher levels and to vistas, to see what is beyond.

Garden design analogy

For this Wuxi Clinic project, the design team adapted these interior design goals to relate to the specific character of the location. Wuxi and the nearby city of Suzhou are ancient towns best known for their canals and for historic classical Chinese gardens. Preserved sites such as *The Humble Administrator's Garden* and *The Master of the Nets Garden* are part of what make nearby Suzhou a unique UNESCO World Heritage city. Our design is inspired by the elements

of these classical gardens to introduce familiar and traditional features on a smaller interior scale, balanced with the technology-driven modern health-care environment.

Chinese gardens for thousands of years have used these concepts of Biophilic Design to create a unique environment that humans find very relaxing and inspirational. These gardens are not just planted outdoor spaces but are conceived as “a microcosm of the world made of basic natural elements such as water, stones, plants and different building components as a literary allusion.”

Garden design is intended to inspire a calming spirit and also inspiration, excitement, and mystery to invigorate the users of the garden. The physical elements often include borrowed views from one area to another, barred views or opposite views, framed or screened views which are intended to recreate the splendors of natural scenery. A Chinese classical garden is meant to be seen and experienced in a specific and controlled way, not just as a pretty space.

Visitors are led around water features, with changes in level and frequent opportunities to explore views and climb higher. Pavilion structures, walls, gates, lattice work and ornamentation are all used for spe-

cific purposes to shape these views and to create a composition of natural materials. Beyond just the physical environmental design, literary connotations carry a tremendous amount of information in Chinese culture, with physical parts of the garden intended to refer to classical lines of poetry and literary quotations. Each garden has a series of themes, and each window or wall or landmark planting has a very specific reason. Experiencing the classical Chinese garden design itself can reinforce ideas of a healthy lifestyle.

Proposed design

To build on these ideas, the design team carefully considered each space in the medium scale facility, using different levels of spatial and visual privacy and a careful selection of materials. In addition to the interior elements of the building, a key outdoor feature is the adjacent Bamboo garden, one of four major garden areas on the larger site, each with a specific theme, planting type, and intended function. The Bamboo garden is planned as an area of privacy and decompression, where the tall vertical plants provide shade and seclusion inside a wall of green. Within the garden, wandering pathways lead to shaded wooden decks and sitting areas, with views of small scale water features. Patients, families, and staff members can take a few moments in the garden to relax and think, in a private and inspiring setting. From the outside, the wall of

bamboo is a moving backdrop of green life, and a relaxing visual interest.

The public areas of the Clinic are all oriented toward the Bamboo Garden on the north side, while the upper floors also offer views toward the larger lake on the south side. At the Ground Floor, a private entrance pavilion sets the mood, and the main lobby space looks through the building out to the garden beyond, with direct access to garden circulation. On the upper levels of the clinic, the waiting and public areas are organized on the north side, with views down to the Bamboo Garden, and the occupied patient and staff areas are along the south wall, for ample natural light and ventilation. A green roof at the second floor level offers a private outdoor space which can be used for patient and staff meetings and activities.

Interior spaces use these same principles of classical garden design, with openings in walls to direct views, grille work to provide a sense of partial enclosure, and a mix of clear and translucent glazing to create controlled views and to make the spaces more interesting and more related to one another.

Natural light is an important feature of biophilic design, and the patient and office areas are designed for controlled natural light, using light shelves and dropped ceilings to bounce diffused light into the space along the ceiling plane but without glare. One of the key features of the Chinese building code is that occupied spaces such as offices and exam/consult rooms are required to have operable windows,



Lobby

so each room has the option to open a window for the breezes and natural sound and scent of the lake and the wetlands that are intrinsic to this new Wuxi Ecological City.

The building interior uses sustainable, natural materials such as locally sourced-wood and stone, matte finish ceramics, and textured wall coverings to continue the lake and garden theme and to link these spaces to the natural world. Metal finishes are limited to small areas, using dull rather than polished surfaces, and the reception desks and work counters are natural stone and wood, rather than the usual plastic laminates or composite surfaces. Whenever possible, informal face to face greeting spaces are provided rather than institutional type high counters and reception stations.

Furnishings are selected to reinforce the non-institutional feeling of the Clinic and a connection to the natural world, with wood and textured fabrics, rather than metal and vinyl. At the same time, furniture selections meet the special requirements for durability and clean ability in a healthcare setting, and design criteria such as higher seat heights, sturdy arms, and provisions for wider bariatric seating which make the furniture safer and more comfortable for patients and families.

Related medical services

The Wuxi Integrated Medicine Clinic is planned to work closely with the other components of the Taihu New City health center. Patients who use the Clinic for proactive health assessment and health maintenance will also have access to the adjacent Ambulatory Care Center, with a wide range of outpatient healthcare services and diagnostic imaging; the Women’s Hospital, with 600 beds and full Obstetric, Surgery, Women’s Health and Cancer services, and the adjacent Maternity Center and Rehabilitation Center. The Maternity Center is a very specific part of Chinese medical care, providing 30 days of follow up care for women after delivery, with care provided for their children, to encourage bed rest and recovery. The adjacent Rehabilitation Center offers a range of physical and occupational therapy services for both inpatients and outpatients; both of these non-hospital services are located near the canal bordering the site, away from hospital and ambulatory care traffic.

The Integrated Medicine Clinic will be the most visible and iconic feature of the health center, and its use of biophilic and Salutogenic design principles will be a strong expression of the goals of the Wuxi project. □



Front entrance



Atrium

Richard Sprow



Principal, International Healthcare Facilities, Perkins Eastman Architects, Shanghai

Richard Sprow has more than 40 years of specialized experience in healthcare facility planning. His work has included master planning, programming, conceptual design, interior design, and project management for hundreds of clients throughout the United States, Asia, and the Middle East. His project experience includes acute care hospitals, rehabilitation hospitals, long-term care facilities, and a wide range of ambulatory care, diagnostic, emergency, imaging, cardiovascular, and rehabilitation services. Mr. Sprow now resides in Shanghai China and leads the Perkins Eastman medical planning team for China and international projects. Previously, Mr. Sprow was a Principal at Perkins + Will, VP Architecture at URS Consultants, and health care practice leader at HLW International.

Xiaodan Luo, B.



Medical Planner, Perkins Eastman Architects, Shanghai

Xiaodan is an architect and medical planner with a focus on healthcare projects, ranging from planning assignments through full design services. She is a graduate of South China University of Technology and Master of Architecture program with the Certificate in Health System & Design at Texas A&M University. Xiaodan is an advocate for working in a highly collaborative manner taking into account the needs of all project stake holders. Most recently she has worked on medical planning and project design for new and renovated health care projects in China, India, and the Middle East.



The greenery planning around the organic shape integrated with nature.

Hospital Südspidol, Esch/Alzette Luxembourg

Albert Wimmer

ARCHITECTURE

The concept for the design of the new hospital Südspidol in Esch/Alzette in Luxembourg adopts a campus typology and combines the rational organisation of functions with a human scale to improve way-finding and optimise efficiency.

By focusing on the needs of the patient, the concept develops the architecture to create an atmosphere of well-being. The design maximises day-light, optimises orientation and provides a variety of views into the surrounding green spaces (or landscape). The hospital rooms radiate safety and tranquillity and, not only provides space for privacy, but also for caring and communication. The main goal of the design is a highly efficient, process orientated hospital with a focus on the patients' needs.

From a bird's eye view, the triangular Inpatient structures with their rounded edges, suggest landed UFOs. This specific layout improves the legibility and good observation and reduces travel distances. Each building element, though connected with other parts of the hos-

pital, is self-contained, functionally independent and can be accessed separately. The hospital is divided into separate building forms that are connected the logistics accommodation beneath the ground. The concept, with its clear and memorable design language, is an opportunity to signal an important and new direction for the future of hospital development.

The exterior appearance of the new hospital is characterized by its disaggregation and formal language. The soft and gentle forms contrast with the rational clinical functionality. The hospital is perceived as an integral part of the familiar surroundings (or "landscape").

That's the fundamental idea of the new hospital: patients, staff and visitors won't be confronted by a mega structure, but come to experience individual structures at an appropriate scale. The spatial arrangement provides spaces for social interaction and exchange.

The design of the façade incorporates this idea and supports it through the extensive use of wood as a



Model of the project.

building material. This creates a warm, organic mood that radiates (conveys) trust, intimacy and warmth. At the same time, the use of renewable materials, such as wood, play an important part in (OR “contributes to”) the “green hospital” concept. The combination of design language and materiality gives the hospital a distinctive “face” and contribute to it’s identity and identity and sense of place

FUNCTIONALITY

The use of a new model based on the additive geometric form of an equilateral triangle creates high clarity and orientation and helps to keep the distances short. The proposal clusters individual functional units and provides a clear and legible structure. The campus concept ensures a functional and rational arrangement of the building forms with a clear circulation system.

Within in the centre of each functional unit there will be open zones that enable the flexible arrangement of shared uses. They support communication and the interaction of people and processes.

The essential criteria for the distribution of the functional areas is their specific frequency and intensity of use: the outpatient departments and diagnos-

tic centres (high frequency, low intensity) are located in close proximity to the main access on the ground floor and 1st floor, while intensive care units and surgery areas (low frequency, medium to high intensity) are positioned in protected areas on the upper levels. The day-clinic and areas of intervention (medium frequency, medium intensity) are located in the central part of the hospital and therefore provide an ideal connection to the outpatient departments and the hospital wards.

LIFE-CYCLE HOSPITAL – GREEN HOSPITAL

The life-cycle concept is based on the wish to create a building with a long-lasting performance and high flexibility. Because requirements concerning hospitals and methods of medical treatment are constantly evolving, the flexibility of the building and the need to meet future demands appear to be particularly relevant. Due to the unique triangular layout the hospital Südspidol has all the flexibility and adjustability it requires. Structural stiffening components are reduced to a minimum and later modifications and adaptations can be carried out easily.

In addition, the concept provides the possibility for anticipated penetrations and perforations in the entire ceiling area. This ensures that Südspidol will be able to respond flexibly to future developments and demands.

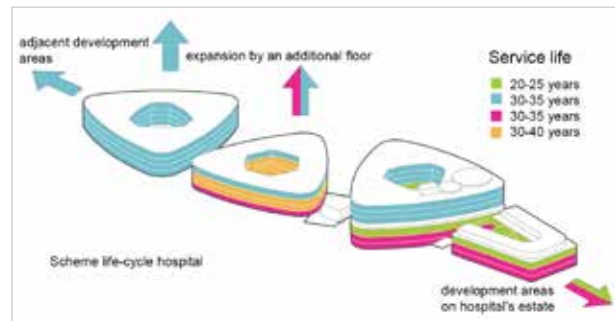
The urban integration of Südspidol enables extension areas on two sides: in the West, right at the traffic junction, there is scope for the potential expansion to house areas for critical care (OR and intensive care) units. THESE ARE THE SAME THING! In the East there is the possibility to extend the building in connection with the low care area. This duality guarantees the maximum possible flexibility and enables a fast and direct respond to changes.



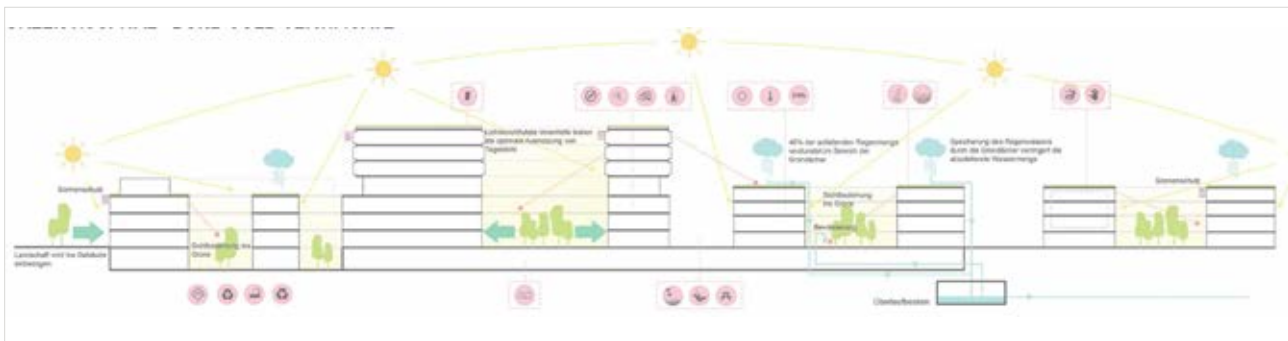
Architecture with maximum access to daylight.

The zoning in different functional centres corresponds to the medical processes and their frequency and provides a consequent separation corresponding to their service life. In accordance with the key points of the spatial programme, the individual modules are carefully arranged to provide optimal accessibility, short distances and clear legibility of the different areas.

As a “green hospital”, Südspidol contributes to the ecological sustainability as well as the social sustainability. The selection of building materials is based on ecological assessments; differentiated vegetation



Flexibility and expansion possibility.



The shape and the access of daylight and use of wastewater.

helps to improve the micro climate. All roof surfaces are to be used as green roofs or for the implementation of solar panels. Südspidol supports environmentally friendly transport and will provide opportunities for e-mobility and bicycle traffic.

LANDSCAPE DESIGN

The flowing geometry of the landscape design creates a vivid, harmonic and interlocking mood of well-being, with water as an additional calming element. The landscape design provides an important contrast to the clinic structures of the hospital offers possibilities to experience nature and supports the recovery process. Visiting the park, surrounded by lush greenery and enjoying idyllic parkland views increases positive experiences and reduces negative emotions.



Green landscape design well integrated with surrounding.

To the inclusion of landscape elements such as the promenade, the wooden decks near the waterfront and the continuous network of paths, the park can be used as a private part of the hospital as well as a public open and green space. For patients and visitors alike the park provides leisurely and easy walking paths with high value of inhabitation. The network of paths loops through the park; every single trail has characteristic features, such as its length, which increases the motivation to reach the next level of mobility and to extend the range of journey. Between the trails, amorphously planted “islands” invite the patients and visitors to linger and rest.

The park is not just an important part of the hospital, but also plays an important role as a nature reserve for the surrounding districts and as an urban reference point. The urban design concept, based on the integration of the new hospital in the surrounding environment, creates a harmonic connection between the hospital buildings and the green and open spaces as well as the connection between private and public spaces.

The design language of the landscape design emulates the layout of the hospital buildings. The individual components of the hospital define an entrance gate to the natural area and provide a flowing transition to the network of trails that connects the buildings with the outside area.



The simplicity of shape and easy wayfinding to reduces stress.

HEALING SUPPORTIVE ENVIRONMENT

Autonomy and self-determination, differentiated zones for conversation and retreat, as well as a clear and distinctive division between private and public interaction are at the focus of the project. The architectural design supports the varied encounters and interactions in the hospital, while ensuring that the human need for self-reliance and mutual respect is fulfilled.

Bright, light-flooded rooms, the use of natural forms and “healing colours” such as can be found in nature as well as a leafy view contribute to a pleasant and relaxed atmosphere. Sound-absorbing materials contribute to a noise-free environment that has a stress-reducing effect on the patients as well as the hospital staff.

Supplemented by a selection of suitable artworks and especially designed gardens and roof landscapes, the result is a holistic-spatial experience that optimises the atmosphere and supports the recovery process. In order to meet the desire for privacy and free access to the patients’ belongings, each patient will be equipped with a specially designed mobile cabinet that can be moved to wherever the patient goes.

In order to satisfy the basic need of involving the patients families, throughout the hospital there are places that can be used for intimate meetings and exchange. Additionally, there will be the universal provision for relatives to spend the night in the patients’ room.

Patient rooms of the future

Each of the approximately 600 1-bed patient rooms is designed from the point of view of the patients; their needs and requirements underpin each room layout. The design includes clear zoning princi-



Single bed room for patient with maximum access to daylight.

ples, consideration of the relationship between the in- and the outside, the specific configuration and concept of same handed rooms combines the most important parameters of a cutting-edge conception.

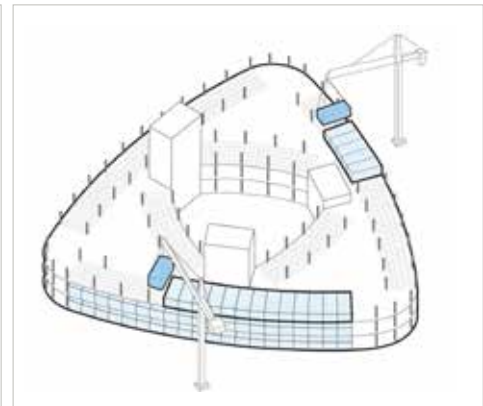
The rooms provide a homely atmosphere that is supported by a prudent selection of materials, the use of natural colours and appealing haptic (tactile) surfaces. The wall opposite the patients’ beds will be equipped with an extensive media wall that provides access to the internet and various entertainment options, but can also be applied to discuss treatment with the help of images.

MODULAR CONSTRUCTION PRINCIPLES

In order to achieve a high degree of flexibility and modularity, the structural system is principally designed to enable a change in use. The load-bearing parts are to be realized in concrete construction which will enable suspensions for sensible equip-



The creative design of patient room.



The Modular design to facilitated construction and efficient investment.

ment because they provide the needed dynamic absorption. At the same the structure has the required redundancy for future swinging columns.

The ceilings are executed as flat or mushroom construction carried by columns which are positioned at a mutual distance of 8 to 10 metres without joists. Because of this, the construction achieves a high flexibility in respect of functional changes.

The stability of the construction is braced by the staircases and the elevator shafts, whereas the technical shafts can be executed with flexible boundaries. Through this construction, it is possible to adapt the shaft areas according to changes in the clinical and technical requirements, should the need arise.

The foundation is designed as a reinforced concrete slab that will, according to the geotechnical studies, present a consistent formation level. The multi-storey construction will ensure sufficient security against uplifting.

The proposed element-façade system will enables a high degree of pre-fabricated construction elements and the possibility of replacing even larger components of the technical equipment by gaining access

through the façade. This helps to simplify maintenance and reduce costs.

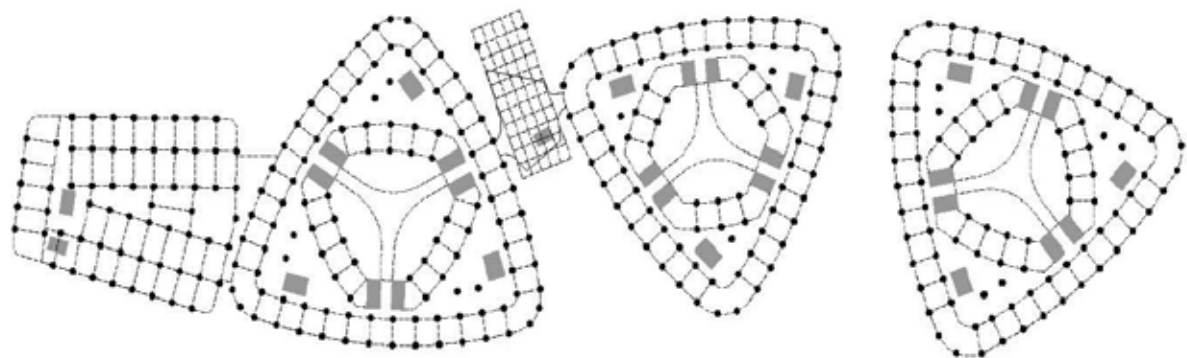
The interconnecting bridges between the buildings will be user-friendly and aim to achieve an optimal route network between the hospital buildings. On the inside the construction is self-supporting and vibration-free.

INNOVATIONS

In the interests of a forward-looking, cutting-edge concept for the new Centre Hospitalier Emile Maysrisc it is essential to pursue a strategy that consciously exceeds the state of the art.

Therefore, the proposed design has to anticipate all possible future developments and to provide adequate solutions.

Based on international best-practice models and on evidence-based studies, the concept has to consider and identity changing trends within a medium to long-term vision. To achieve this, the project contractually is required to illustrate the following main trends:



Layout plan – modular construction principle.

- Future direction of the needs and requirements of the hospital staff.
- Optimisation of processes.
- Integration of supplies.
- Consideration of increasing outpatient treatments

Strategic goal:

Patient-friendly environment

- Easy orientation and guidance through entire hospital.
- Separation of patients routes and supply routes
- Transparent and legible organisation of the functional areas.
- Separate access to dialysis areas and obstetrics areas.
- Single/One bed-room's connection with nature.
- Family zones within the patient areas.

Strategic goal:

Functional and employee-friendly environment

- Centre-focussed arrangement of the hospital buildings.
- Short distances.
- Appealing working spaces with a high proportion of natural daylight.

EXCERPT OF THE JURY PROTOCOL

(Dating from October 21st 2015)

Regarding the arrangement and conception the hospital buildings

“The arrangement of the functional and spatial allocation plan is considered to be beneficial because it provides easily understandable and clear zones for staff and patients alike. The conception of the functional layers complies with the clients wish for distinction.”

Regarding the quality of internal and external spaces and user-friendliness

“The individual structural forms open up opportunities for innovative room layouts within the hospital. The triangular structures are connected through an access system on the ground floor and partially on the first floor. The network is spatially attractive, helps to reduce the distances and provides clear orientation.”

“The appealing character of interior spaces, especially in the inpatient units, benefit both patients and visitors. Through the waiving of a system of corridors, the spaces provide extensive, lounge-like zones.”

Regarding the quality of the patient rooms

“Of particular positive importance are the considerations for the design of the patient rooms: the interlocking system of pre-fabricated modules creates optimal zoning within the rooms and provides the necessary conditions for a variety of possible uses as well as the possibility to adapt the spaces should the need arise. The jury welcomes explicitly the valuable consideration of safety, comfort and economic efficacy. The project excels through its good ergonomic design for staff, the organisation of inpatient units and efficient circulation.”

Regarding sustainability

“The concept meets all requirements of a life-cycle hospital. Particularly noteworthy is the modular design that enables a thematic usage. Scenarios of a future further development are quite conceivable. The urban arrangement shows an area of enlargement in the western part of the hospital and therefore opens up a capacity for growth with the size of about 20% of the present spatial programme.”

Regarding realization

“The structural concept is simple and logically structured. The flat ceiling structures enable a flexible use and a good layout of the technical buildings.”

Regarding economic efficacy

“Regarding the operating costs: a good ratio between usable floor area and gross floor area is to be expected. The short distances within the hospital are a particularly important contribution to the issue of personnel costs. The concentration of three wards on one floor makes it possible to obtain synergies. The organisation of the patient rooms provides optimised and safe procedures.”

Regarding building costs

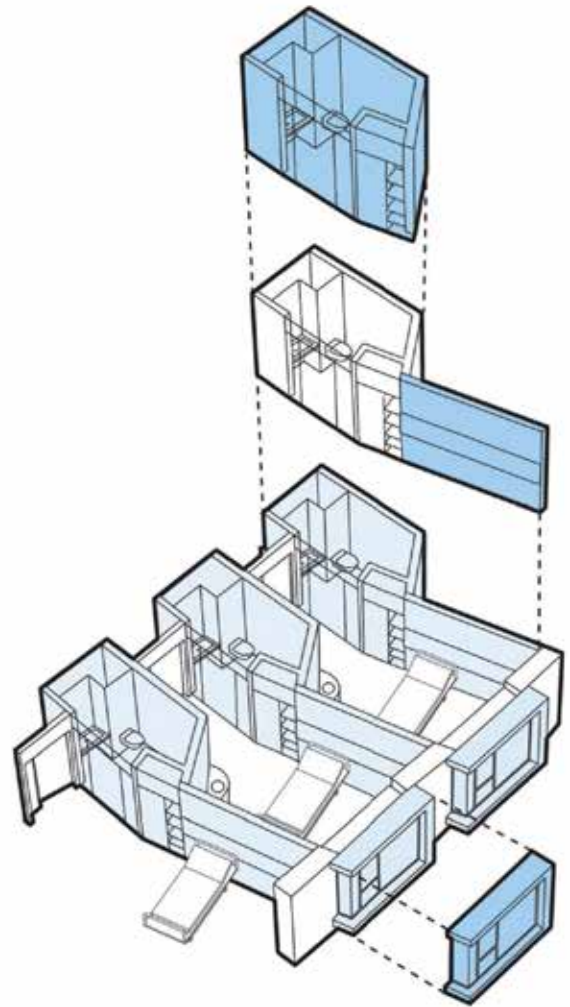
“The anticipated building costs are mainly influenced by efficient space management and will lead to appropriate investment costs.”

Regarding innovations

“The open and comparatively loose pavilion-like structures can be the exemplar for an open, future orientated hospital structure. Corporate Identity stands as a sign for architecture centred on the human being and its dedication to the needs of patients, visitors and staff alike. The shaping of theme buildings improves the orientation for all users of the new hospital. This positive approach is reinforced through the innovative organisational and structural proposal. In this uniqueness lies the opportunity of a sustainable development that promotes different cycles of innovation and cycles of renovation as well as the substitution of themed buildings.”

The design of the inpatient units and especially the patient rooms is optimised and sensitive. The high potential for innovation lies in the final integration of aspects of safety, working efficacy, comfort and economic efficacy regarding investments and operation.” □

“Patients, staff and visitors won’t be confronted by a mega structure, but come to experience individual structures at an appropriate scale”.



Modular construction principle.

Albert Wimmer



Wimmer Architects, Austria

Architect Albert Wimmer studied at the Technical University of Vienna (1965–1971 degree of architecture); 1974–1977 London Architectural Association, diploma of town-planning; Albert Wimmer’s architecture studio was founded in 1977, the Atelier Albert Wimmer ZT GmbH in 2003. Emphasis on residential quarters, health care, urban design and masterplans, infrastructure, sports and leisure, culture and buildings of temporary use. The approach is characterized through social and ecological aspects but always with regard to town planning. Selection of current projects: Vienna Central Station and masterplan, residential area “Eurogate” and masterplan and the ongoing development of the health quarter including “Vienna North Hospital” in Vienna.

CLIENT

Centre Hospitalier Emile Mayrisch, Luxembourg

The bidding consortium known as HEALTH TEAM EUROPE led by Albert Wimmer ZT-GmbH, in collaboration with Architects Collective ZT GmbH Rambøll (structural engineering and building services) and Martha Schwartz Partners Ltd. (landscape architecture) has been concluded with a general contractor's agreement.

ARCHITECTURE

HEALTH TEAM EUROPE – Albert Wimmer ZT GmbH/Architects Collective ZT GmbH, Vienna (AUT).

LEADERSHIP

Albert Wimmer ZT GmbH

ENGINEERING AND BUILDING SERVICES

Rambøll, Copenhagen (DK)

LANDSCAPE ARCHITECTURE

Martha Schwartz Ltd. London (UK), Boston (USA)

FIY-THROUGH

© HEALTH TEAM EUROPE

RENDERINGS

3dbakery

PROJECT DATA

International 2-stage Design Competition Application, September 2014

1st stage

October 2014 – submission date: January 12, 2015

Invitation to 2nd stage

April 9, 2015

2nd stage

April 2015 – submission date: July 29, 2015

Notification of 1st prize

October 28, 2015

Number of beds

Approx. 600

Site area

111.366 m²

Number of overnight beds

594 (with 27 wards)

Number of day beds

38

Parking spaces

995 (60 external, 935 in parking garage)

SCHEDULED TIME TABLE

Commence Planning: January 2016

Commence construction: 2018

Completion: 2022



The organic form of courtyard for the view from all the rooms and place for contemplation.

www.sakhiwo.com

Vision

To be an outstanding leader in health and other public infrastructure development, while meeting the needs of the client and the community.

Mission

We are committed to excellence in design and implementation of high quality, efficient and cost-effective solutions. We aim to respond accurately to the transformation of health care, education, housing and infrastructure delivery by developing outstanding facilities.

Sakhiwo Infrastructure & Health Solutions is a multi-skilled consultancy company.

We specialise in strategic health planning, health briefs, facility planning, architectural design, project and construction management, health technology, consultancy and advisory services related to hospital infrastructure development, commissioning and health facility maintenance management.

Sakhiwo acts as an implementing agent/multi-disciplinary development agency for hospitals and health facilities and pulled together some of the best expertise in South Africa for the establishment of Sakhiwo Infrastructure and Health Solutions.

CURRENT PROJECTS

South Africa

- Cecilia Makiwane Hospital
- Lilitha College of Nursing
- Frere Hospital, new Oncology and ICU
- Sipepetu District Hospital
- Thabazimbi District Hospital
- Letaba Regional Hospital

Zimbabwe

- The Avenues Woman and Child Hospital
- Selborne Hospital

Mozambique

- Nampula General Hospital
- Maputo Central Hospital

The Gambia

- Horizons Private Clinic (TA for AfDB)

Namibia

- Otjiwarongo Referral Hospital
- Ondangwa District Hospital
- Khomas District Hospital
- Katutura Hospital
- Windhoek Central Hospital

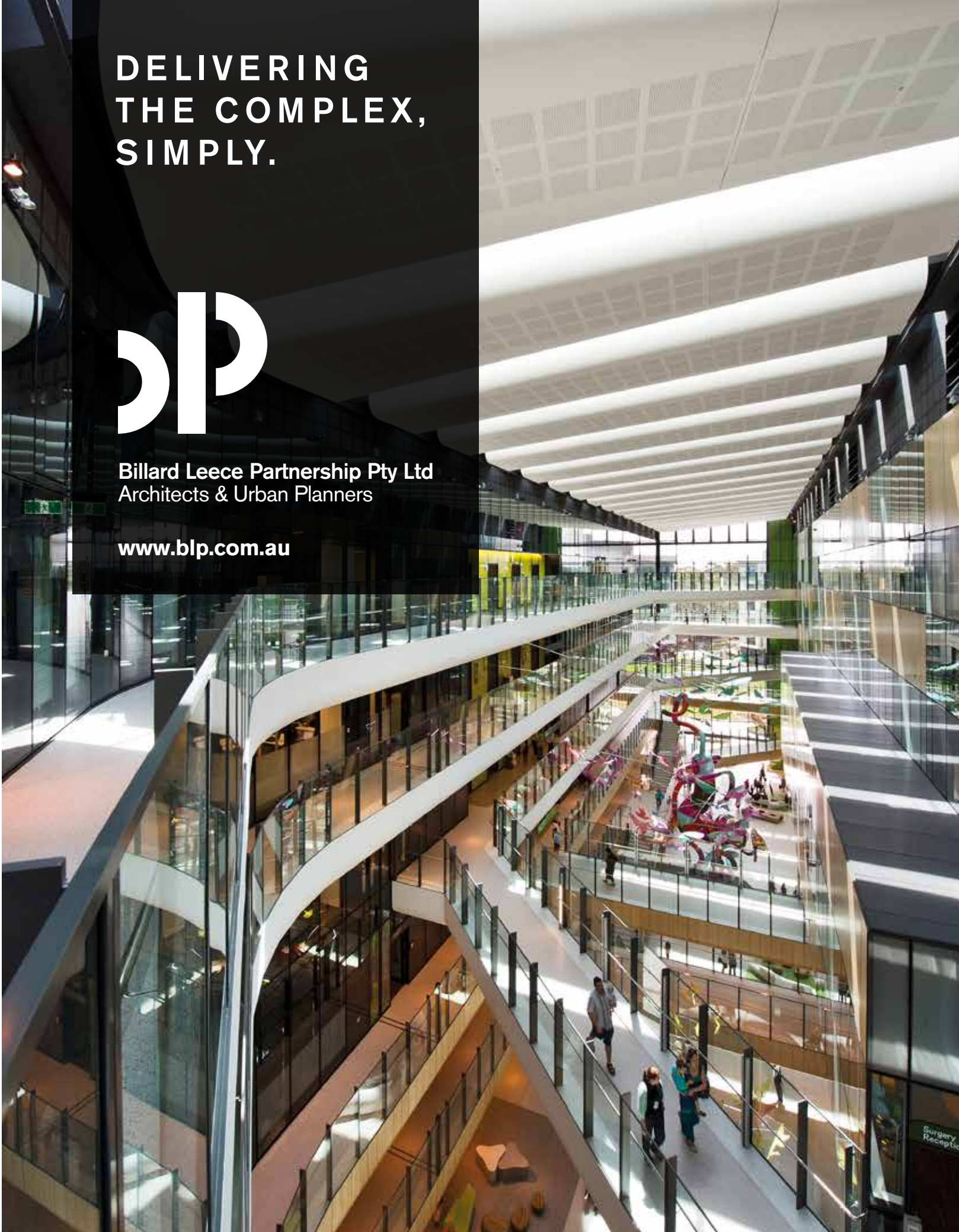


**DELIVERING
THE COMPLEX,
SIMPLY.**



Billard Leece Partnership Pty Ltd
Architects & Urban Planners

www.blp.com.au





PERFORMANCE DRIVEN
DESIGN

GLOBAL PERSPECTIVE
LOCAL EXPERIENCE



CallisonRTKL.com
888.337.4685

CALLISONRTKL
A DESIGN CONSULTANCY OF ARCADIS

HealthQuest - Vassar Brothers Medical Center - Poughkeepsie, NY