THE NEW ARCHITECTURE PARADIGM IS HEALTH

International Union of Architects (UIA)
WORLD ARCHITECTURE DAY 2022

3 October 2022

Dr Jako Nice
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<td>* Life expectancy</td>
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2020 - Current: 50% of the 7.5 billion people globally reside in urban environments.

2050 - Estimate: 68% (9 Billion)

2060 - Over the next 40 years: Africa 300%: 395 million - 1.3 billion

[https://www.un.org](https://www.un.org)
HEALTH

THE DATA

SOUTH AFRICA 2022 - 60.55 MILLION POPULATION

DEVELOPED WORLD COUNTRIES ESTIMATE HAI RATES: 9.8 PER 100 PEOPLE
DEVELOPING WORLD COUNTRIES ESTIMATED HAI RATES: 15.5 PER 100 PEOPLE

(Durlach et al. 2012; Alvarez-Moreno et al. 2014 and Brink et al. 2006)

LOCAL HEALTH IMPACT SOUTH AFRICA_TB/HIV/COVID19

2021 - COVID19: (4.02 Mill cases, 102 000 deaths)

2019 - TB INCIDENCE RSA average 615 / 100 000
2017 - TB INCIDENCE (in high incidence areas) 1165 / 100 000
2019 - TB MORTALITY 58000 (62% HIV Co-infection)
2018 - HIV AIDS INFECTION 7.7 Million
2017 - AIDS MORTALITY 71 000

(CDC 2020, SAMJ 2019, WHO, NIOH)
PRACTICAL APPROACHES
DO YOU CONSIDER IPC

Appreciate the variety and persistence of microorganisms

- The spread of infectious bacteria, fungi, viruses and single cell organisms (*prokaryotic & eukaryotic*) specifically in hospitals are widely known to be first by human contamination (Hospodsky et al. 2012)

- Secondly dependent on environmental conditions (Basu. et al. 2007).

- This is exacerbated when microbial favourable environmental conditions are provided (Wolfaardt. et al. 2018).

Emerging and re-emerging diseases
BUILDINGS ARE NOT ISOLATED ARTIFACTS; THEY FORM PART OF A LARGER SYSTEM: AN URBAN ECOSYSTEM.

HOW THE ECOSYSTEM RespondS IS DEPENDANT ON THE SERVICES IT PROVIDES AND RECEIVES, AND THE SOCIAL DRIVERS OF THE SYSTEM.
INFECTION PRINCIPLES
METHODS OF INFECTION - THE HIDDEN BE FACTORS

PROBABILITY OF INFECTION - simplified

\[ P_{inf} = \frac{\text{new cases}}{\text{susceptibles}} = 1 - e^{-\frac{Iqpt}{Q_oa}} \]

\[ I_p = \frac{(D \times S \times T \times V)}{H_δ} \]

D) Dose, S) Site of contact, T) Time of contact, V) Receptive host site, H) Force of combined immunity

Receptive host, site of contact, time of contact, infectious dose

BASIC REPRODUCTIVE NUMBER \((R_0)\)

For each sick person how many subsequent new people will be infected – the contagiousness of an infectious disease

\[ R_0 \text{ Factors: receptive host, site of contact, time of contact, dose) } \]

Infectious period
Contact rate
Mode of Transmission

Ebola (2) HIV (4) SARS (4-5) TB (0.24-4.3) Measles (18)
We have come a long way, but we have yet some distance to go. 
Moving from intra - to inter - to Transdisciplinary architecture

Architecture is the will of an epoch translated into space.
Mies van de Rohe
Architecture
Engineering
Microbiology
Biology
Anthropology
Medical
Human Sciences

Shared factors and common variables
Functional outcomes and interdependencies

Interdisciplinary
Transdisciplinary

Alexander Refsum Jensenius
• Policy and Service Context
• Strategic planning
• Site selection
• Briefing the implementing agent or consultant team

• PLANNING AND DESIGN
• Public sector
• Private sector guidance

• First, do no harm
  • Healing environment for users
  • Occupational well-being and motivation for staff
  • Accessibility and inclusive design
  • Emergency preparedness and resilience
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<td>Facilities for Surgical Procedures</td>
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<td>TB Services</td>
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**LEGEND**
- Guidelines
- Toolkits
- Position papers
- Regulations
BROAD RISK ASSESSMENT TOOLS 2015-2022

CASE STUDY (2)
Council for Scientific and Industrial Research (CSIR)
MICROBIOLOGY OF THE BUILT ENVIRONMENT

CASE STUDY (3)

Refers to the entire habitat, including the microorganisms (bacteria, archaea, lower and higher eukaryotes, and viruses), their genomes (i.e., genes), and the surrounding environmental conditions. The microbiome is characterised by the application of one or a combination of metagenomics, metatranscriptomics, and metaproteomics, together with clinical or environmental metadata. (Marchesi & Ravel 2015)
The turning Torso – Calatrva (Geben)
https://www.archute.com/the-turning-torso/

Adapted from, Richard Corsi, PhD
“Building programs: Hospitals are often considered to be driven by strong programs, but have the tendency to shift between weak and strong.” (Sailer et al, 2013)

For example, Offices have weaker programs. (most probably easier to manage IPC)

- Weak = Space configuration dependant vs
- Strong = Rules and policy enforced on the space

Building program and design reveals a new layer of infection prevention and control (IPC) complexity in the built environment form. A stronger programme will in fact present a more temporal and dynamic microbial community, which is not only determined by the physical spaces but also by the movement and activity between them.
Spatial analytics should be core to all design processes, to understand the impact of planning and design decisions.
MoBE CASE STUDY
THE SOUTH AFRICAN HOSPITAL MICROBIOME

Behavioural choices… cleaning frequency, procedure, animals, crowding etc. We find a correlation with the change in flow patterns, occupancy and the quanta of prevalent organisms. (in the number of Operational Taxonomic Units (OTU))

Ventilation is a sources drivers for distribution.***

The ventilation method accounts for a greater variance in airborne bacterial pathogenicity than ventilation rates alone.***

Layering infection prevention and control (IPC) policies and protocols onto a building system in effect makes the program stronger than the configuration

Key factors the influence built environment microbiome: Season, Geography, Ventilation, People/occupancy, Building material
Greater core integration in winter, from the microbial sampling indicated an increase in the number of Operational Taxonomic Units (OTU), i.e. a larger number of identified microorganisms compared to other rooms for both buildings
A number of studies investigated the microbiome of the built environment but with far less rigour with regards to built environment factors than the 4 studies mentioned.

The omission of built environment factors studied in conjunction with microbiological characterisation studies results in underreporting of potential factors that influence the microbial community and limits the characterisation of the microbiome of building indoors.

With only 4 of the - in excesses of 50 journal articles reviewed.

Researchers recognised that building occupants directly, and, by extension, the architectural design (through factors of building design, planning, occupancy and use patterns) impacts on the microbial diversity and community composition of the building microbiome.
Healthy Buildings, Healthy Cities Lab

The HB&HC Lab initiative aims to stimulate new thinking and build research and development initiatives to drive healthy building design and construction.

Towards the creation of healthy living environments at building, neighbourhood and city scale, specifically in South Africa but having resonance across Africa and globally. COVID19 and related health care associated infections (HAI), nosocomial disease burdens (TB etc.) and the contamination role of the built environment in Southern Africa and globally positions this work as critical.

The HB&HC Lab aims to stimulate transdisciplinary thinking, research and future planning and design for health in a Global post-COVID-19 world.
We live on an island surrounded by a sea of ignorance. As our island of knowledge grows, so does the shore of our ignorance.

John Archibald Wheeler - American Theoretical Physicist 1930

We have yet much to learn.... and, much to gain in order to create healthier people-centred cities and spaces
THANK YOU

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