Recent developments in healthy city design

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Abstract: This paper reviews the recent developments in programs and tools for healthy city design with special reference to densely populated cities. The research agenda that underpin the development of these programs and tools are also discussed. The review shows that progress in healthy city design must be built upon theories that explains the relationship between the hardware and software of city at all levels (such as urban landscape, planning, building design, development density, infrastructure, traffic management, building management etc) and the physical and mental well being of its citizens. Since data on the latter is often difficult to come by, observable factors that are known to have a direct bearing on human health conditions such as air quality, water quality, noise level, thermal comfort etc are used instead. The discovery of these theories requires knowledge from different fields and thus calls for a multidisciplinary approach. In addition, many recent programs and tools for healthy city design also aim at resolving implementation issues. Resolving these issues is often the key to building a healthy city.

Keywords: environmental health risk, healthy city, research agenda, SARS, sick building.

1. Introduction

1.1 Urbanization and Sustainable Development

Significant increase in population and economic growth in the last century have resulted in significant changed the life style of modern people. One of the consequences of the recent population and economic growth is the rapid expansion of cities and increase in population density in the urban areas [1]. There are many cities that have experiences this process. An example is Hong Kong, one of World's thirteen Mega-cities [2,3]. Hong Kong also represent a typical unplanned development that responses to external forces. One of the forces is the rapid growth in population resulting from immigrants from the Mainland China since the 50's. The growth population represents an increase of 1.0 million/decade until recently [4]. At the same time, there has been relative little investment in improving the urban environment. As at the end of 2001, only 21% of Hong Kong's overall land area is built up area. At the same time over 50% of its population live and work in urban areas, as a result, population density reaches 46,000 people per sq. km. in the densest areas, and an overall average of nearly 5,000 per sq. km. While there is there are economic reasons as to why people life in a compact city, there are also significant costs has impact ton the quality of life and health. The rapid urban expansion in response to external forces is typically unplanned and ignores the implication on the health of its citizens. It is only until recently that citizens in the densely populated cities realized the importance of environmental health called for sustainable development strategy for a improving the living environment and a healthier city design. Hong Kong is not a unique cased. There are many cities facing similar problems in China, Asia and the world. The purpose of this paper is review recent development in solutions to these problems and to identify the relevant research issues.

1.2 Health Risk in a High Density Environment

In 2003, the World Health Organization (W.H.O.) has warned that, due to concentration of urban population, "traditional environmental risks such as high poverty incidence, malnutrition, dysentery, skin and eye infections, and other water-sanitation- related diseases are exacerbated by modern environmental risks such as exposure to hazardous and toxic substances, industrial water pollution, air pollution from industries and vehicles, noise, and stress due to lack of space and lifestyle". Both modern and traditional environmental risks, increases with population density. This is clear demonstrated by the recent outbreak of Severe Acute Respiratory Syndrome (SARS) epidemic on March 2003 in Hong Kong and cities alike. This outbreak of SARS is also promulgated by certain unfavorable features in the physical environment. Field visits by WHO confirmed the inseparable relationship between the physical

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environment and health hazards, which led to recent focus by professionals and researchers on environment-related health hazard resulting from design and management of the built facilities in a densely populated urban environment.

Suggested by local researchers and professionals, over-crowding and ultra high density is an urban heritage for many of the Asian cities. For instance, since the Nineteen Seventies, Hong Kong residents have adapted to a compact way of life. In Hong Kong, a common housing form is a private residential estate in an inner city district, which typically includes ten or more number of towers each with 40 stories and 8 families per story, often built on the roof of a shopping mall serviced by efficient public transportation. The Amoy Garden in Hong Kong, where the outbreak of SARA occurred, is a good example of such design (Fig. 1). In typical high density development in Hong Kong, there are often more than ten thousand people living in a single housing development of no more than one km^2. They live so closely to each other that there is hardly any privacy, open space, sufficient daylight or natural ventilation by world standard. With respect to the scale of these buildings which was designed based on cost-effectiveness as a prime motif, the housing form and layout resulted is a tower with a central structural core (with three or four banks of high-speed elevators, fire escape stairs, and chute for rubbish disposal, etc.) giving access to 8 family units, all planned to face outwards, for access to daylight, ventilation and view (Fig. 2). All seems to be fine except the kitchens and toilets in these units are, typically, grouped together to have their windows faced out into a common well-liked open air known as a "re-entrant". The poor ventilation, improper and maintenance of drainage system in these "re-entrants' are responsible for the outbreak of SARS in Amoy Garden.

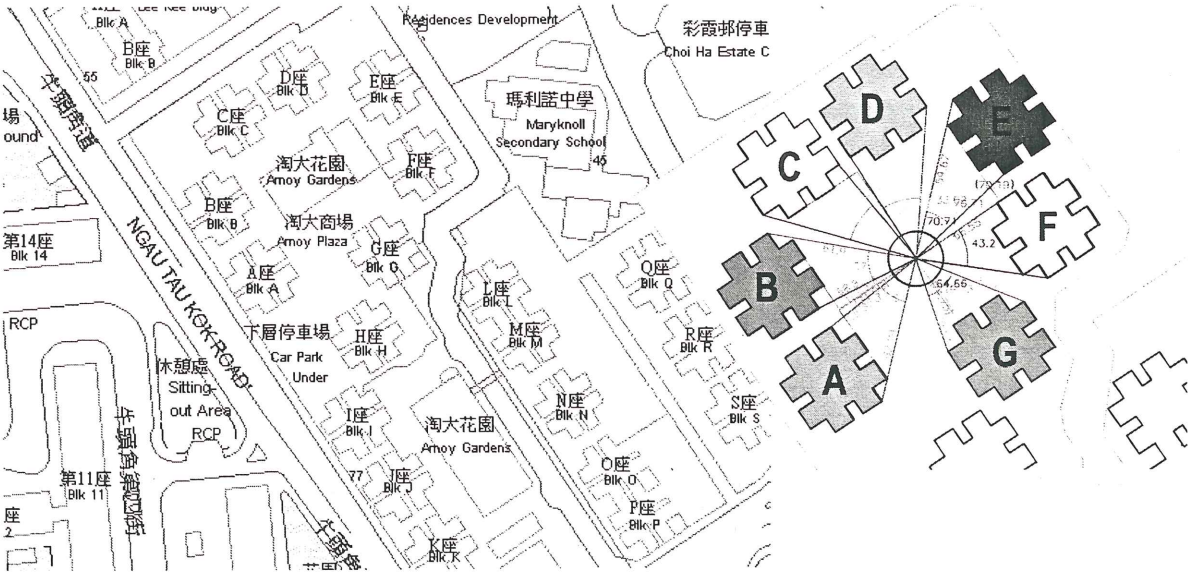

Figure 1a: Site Layout Plans and Floor Plans of Amoy Garden

Behind the economies of scales enjoyed by a compact city, the SARS episode shows that there is a significant cost to the apparent benefit, environmental health risk, a risk ignored by cities of compact cities. The outbreak of SARS has prompted Faculty of Architecture, The University of Hong Kong to accelerate its research program on building performance assessment, in particular the assessment of the impact of building design and property management on the health conditions of building occupants. A large scale project on the construction of Building Health and Hygiene Index (BHHI) has been launched in June this year. This project is a inter-disciplinary research that aims at assessing and publicizing the health and hygiene conditions of building using the BHHI in Hong Kong. The project is funded by both the University of Hong Kong's resources and donations from the community.

2. Healthy city programs

The association of SARS disease with identifiable problems of the physical environment in a highly

compacted city such as Hong Kong prompted the search for a "sustainable and healthy urban form" for densely populated cities. In following section, the authors introduced global and local initiatives that have provided useful information for the next steps forward.

2.1 Healthy cities program

In 1986, the W. H. O. European Regional Office launched the Healthy Cities program with the purpose to "develop health-enhancing public policies that create physical and social environments that would support health and strengthen community action for health, as well as to emphasize the principles of health promotion to develop new styles of enabling, facilitating, mediating, advocating and building new partnerships and coalitions for health".

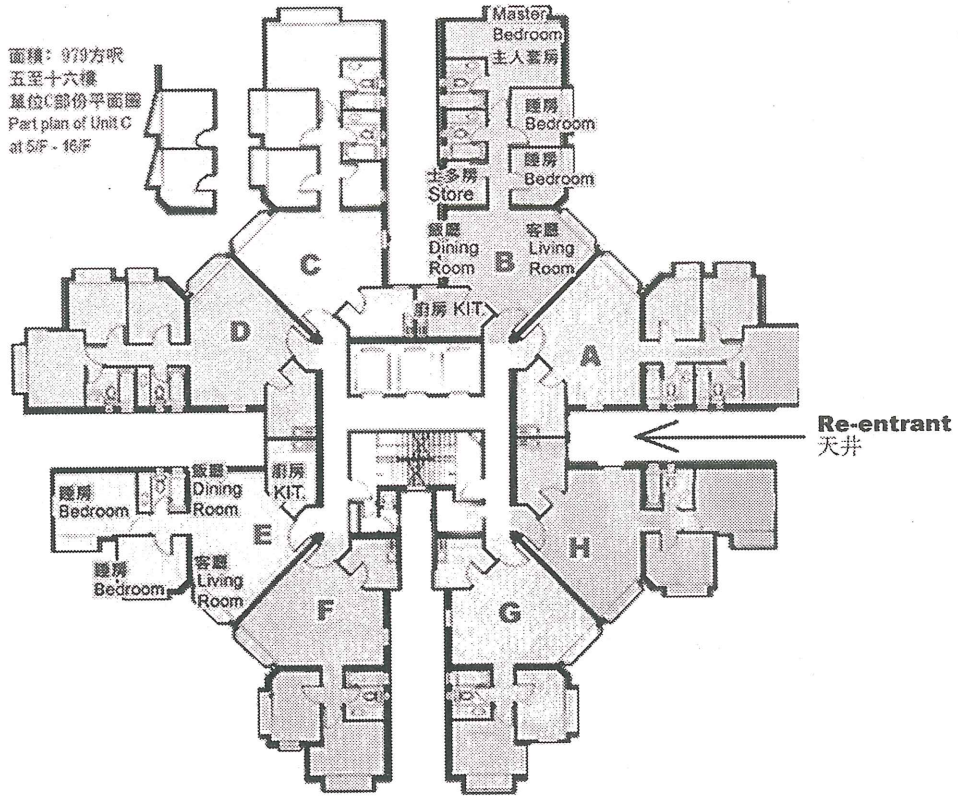

Fig. 2. Typical floor plan of high density development in Hong Kong

It is recorded that over 100 countries has been involved in this program. Initially implemented in the Asia-Pacific region of Australia, Japan and New Zealand, the program recruited Bangladesh, Cambodia, China, Fiji, India, Indonesia, Lao PDR, Malaysia, Mongolia, Myanmar, Thailand, Nepal, Papua New Guinea, Philippines, Republic of Korea, Sri Lanka, and Viet Nam [5].

December 1993 marked the first global conference on Healthy City in California, USA with participants from over 50 countries. After the event, an International Healthy City Foundation was established with the purpose to developing evaluating tools, training, publications and conferences. In December 2003, an international conference is planned in Northern Ireland to celebrate 15 years of the healthy cities movement in Europe and globally; to shape goals, strategies and visions for the future.

Comments made by WHO on the Healthy Cities Program shows that there is no single method applicable to all countries towards healthy city in the light of local political, economic and social considerations. However, a general framework and common steps are developed based on studies in the Western Pacific region. It is recommended that the general framework would be modified after an in-depth study of local contexts.

The main approach of the Healthy City movement is to organize citizens of diverse disciplines "from business, government and other sectors of society who recognize their interconnection can be used to impact the well-being of the entire community" [6]. One

important distinction is that these healthy city projects that are launched around the world integrate people from different interest groups to work as one.

As mentioned, the most fundamental task is to achieve integration. People contributes to the program should involve as many sectors as possible, WHO summarizes a list of key players in the Healthy City to be: community members; local, provincial/state and national politicians; government service providers from a variety of sectors (e.g. health, welfare, transport, police, public housing authority); community service providers; nongovernmental organizations; community-based organizations; private enterprise interests; consumer groups; local government authorities; provincial/state government authorities; relevant national government authorities; ethnic groups; community media; educational institutions. WHO further summarizes the common steps for implementing a healthy city program, depicted in Table 1.

Table 1 Common steps for implementation of a healthy city program [7-9]

Phase 1	◆ Raise awareness of the Healthy Cities concept and approach ◆ Establish an inter-sector initial task force to oversee a Healthy Cities project ◆ Build support mechanisms ◆ Gain strong commitment of the local government
Phase 2	◆ Appoint a steering committee ◆ Develop a city health profile ◆ Develop an action plan for the Healthy Cities project ◆ Integrate activities at elemental settings to gain wider impacts ◆ Raise an awareness of the project Expand capacity of the project
Phase 3	◆ Implement planned activities ◆ Monitor and evaluate the implementation ◆ Revise the action plan as required Develop sustainable mechanisms

The cross-discipline team approach is a consensus approach whereby different needs, concerns and values are put into a melting pot, for prioritization after much discussion. The danger is that a public participation process may take long intervals while societal changes happen at the same time. In Hong Kong, public consultation process is a relative young activity. Also, there are debates about the background and role of the organizer of a public consultation process, whose identity that may dilute the real purpose of the activity.

As an illustration, a case [7] of how to implement a healthy city project in a small city, of 100 000 families, at the meeting point of Malaysia and Singapore – Johor Bahru is presented in Table 2A and 2B [10].

Table 2A. Vision for a Healthy Johor Bahru City by the Year 2005

A healthy Johor Bahru city will be one where:
1. There will be a mature, democratic, community-oriented society, strong in religious, spiritual, and moral values and enjoying a high and optimal level of health.
2. There will be a thriving and resilient economy with emphasis on high technology, capital intensive industry, commerce and information technology, taking full advantage of its strategic location in the region.
3. The population will live in a healthy, aesthetic environment, free of pollution with ample green open space that provides sufficient opportunities for leisure and recreation.

Table 2B. Mission for a healthy Johor Bahru city by the year 2005

Among the programs implemented, on-going or awaiting implementation are:
1. Clean and Beautiful Program
2. Solid Waste Disposal System
3. Hawkers Reformation Program
4. Central Business District Redevelopment Program
5. Dengue Free Program in Bandar Baru UDA (residential communities)
6. Dengue Free Program in schools
7. Increase in Immunization Coverage Program in slum areas
8. Healthy Lifestyle Promotion Program with

NGO: 'Cancer'

The vision of a healthy Johor Bahru city is to be achieved by a strong political will and commitment, and multi-sectoral collaboration with the full support and participation of the community.

As can be seen, the healthy city project is a custom made initiative to address unique local problems related to environmental health issues in residential and school communities.

2.2 The 1992 Rio Declaration

About a decade ago, health and the built environment have been identified to be one of the key factors for livable human settlements. The 1992 Rio

Declaration states "human beings are at the center of concerns for sustainable development ... they are entitled to a healthy and productive life in harmony with nature". In the "Istanbul Declaration on Human Settlements" [11], equal emphasis can be found in its Global Plan of Action and in the statement on "Environmentally Sustainable, Healthy and Livable Human Settlements", with following stated actions:

a) Improve the health and well-being of all people throughout their life-span, particularly people living in poverty.
b) Improve environmental conditions, and reduce industrial and domestic waste, and other forms of health risks in human settlements.
c) Recognize the need for an integrated approach to the provision of those environmental services and policies that are essential for human life.
d) Promote a healthy environment that will continue to support adequate shelter for all and sustainable settlements for current and future generations.
e) Secure for all reliable supply of safe drinking water and meeting the competing demands of industry and agriculture.
f) Improve the livability of human settlements.
g) Develop further international legal mechanisms.
h) Develop mechanisms for assessing the environmental impact of proposed activities.

Of the eight mandates, four deal with the issue of health and the built environment in one way or another (highlighted by authors)

2.3 Research on Healthy and Sick Buildings

Statistical data shows that people spend up to 80% of their time in buildings for varieties of activities, [12,13], and therefore, indoor environment is increasingly a topic of investigation by scientists, professionals, health experts, owners and user occupants. Literature review on healthy and sick buildings often recommends the use of 'indoor environment' as an indicator for healthy buildings, outlining its impacts on occupants and on the larger environment. This is based on the assumption that these indicators have significant impact on the health of the building occupants. The advantage of using these indicators instead of the actual health conditions of the occupants is the data on the indicators are easier to collect, particularly over a short period of time. The type of indicators used can be classified into two main categories (Physically measurable quantities, Esthetic factors) as shown in Table 3.

Table 3. Types of indicators use in healthy building research[14-18].

Physically measurable quantities	Temperature	draughts ventilation air flow rates, air quality
	Noise	
	Light	
Esthetic factors	Layout	light
	Colors	space
	Materials	other subjective elements

The types of indicators are proposed out of an intention to balance mathematical based evaluation and non-mathematical based evaluation. While the former deals with the objective, quantitative, or measurable, the later deals with the subjective, non-quantitative, or non-measurable. The reality is that the second theme proves extremely difficult to be evaluated, as they often involve social and cultural considerations.

The unsatisfactory performance of a healthy building is termed 'un-healthy', or 'sick' building, otherwise known as Sick-Building-Syndrome (SBS). Building scientists have translated the contents of SBS into a parametric checklist for use in a building design process to ensure healthy conditions for the occupants. Generally speaking, SBS is associated with the unhealthy symptoms shown in Table 4.

Table 4. Types of unhealthy symptoms associated with sick buildings[18]

▪ Dryness of the eyes	▪ Itching or watering of the eyes
▪ Blocked or stuffed nose	▪ Runny nose
▪ Dry throat	▪ Lethargy and/or tiredness
▪ Headache	▪ Flu-like feelings
▪ Difficulty in breathing	▪ Tightness of the chest

From those symptoms in Table 4, the causes of sick building are identified in Table 5 for use as design guidance to assist planners and designers to gauge the quality of indoor environments [15].

Table 5. The causes of sick buildings[20]

Category	Causes
Physical factors	Uncomfortable temperatures
	Low humidity
	Low air movement and ventilation rates
	Poor lighting quality and surface coloring
	Poor seating
	Noise
	No control over surrounding environment
Chemical Pollutants	Cigarette smoke
	Formaldehyde vapors from insulation and furniture
	VOCs from adhesives, paint and cleaners
	Ozone from photocopiers, printers and HV sources.
Micro-organisms	Spores and micro-toxins from moulds in ventilation system and wall surfaces
	Dust mites and micro-organisms in carpets, fabrics and plants
	Organisms in drinking water and vending machines

2.4 Relationship building design and environmental healthy

Levin [14]pointed out the views of some researchers who stated that it is more than likely that with good design, construction, and operational practices, buildings can provide healthy indoor air quality with far less outdoor air ventilation than is commonly recommended and even required. In order to protect people in buildings suffered from adverse pollutant sources and in buildings where design, construction, or operational practices are of poor quality, these buildings are recommended to be provided with more ventilation than might otherwise be necessary.

On the other hand, other researchers[21] have highlighted the significance of an integrative approach incorporating urban external factors. There is a need for designers, especially urban designers to work with climatology and related specialist to devise means to design effective urban morphology [22]. Although there is fair amount of research work on those "health issues" of individual buildings, (there have been) very little research on the impact of man-made factors ... especially at urban scale [23]. Clearly, this view coincides with the W.H.O. observation that there is a strong interplay between buildings and their immediate surrounding shown by the SARS incident. In Hong Kong, investigators became interested in the interactions between urban and building design variables from an environmental and health point of concern. Example of one such experiment is the study of daylight - quantity and quality of the so-called "re-entrant" as a built form descriptor. Other areas of interests are found in building development controls, building and population density, land-use and thermal indices, as health-environment indicators.

3. Conclusion

The rapid growth in population and economic growth has result in rapid urbanization in the last century. The urbanization process in many cities is often characterized with unplanned high-density development, often in response to external forces such as industrialization and immigration. Citizens who live in a compact city have long enjoyed the benefit of convenience and other associated economic benefits. However, not until recently, people started to recognize that full cost behind the economic benefits. In particular, the problem of health risk has been under-estimated. This has promoted many studies on the assessment of environmental risk and the approaches to build healthier cities. The recent outbreak of SARS in many big cities such as Hong Kong has also prompted the a more comprehensive research strategy to solve the environmental health issues in an urban areas.

The review recent developments in programs and tools for healthy city design shows that healthy city design must be built upon theories that explains the relationship between the hardware and software of city at all levels (such as urban landscape, planning, building design, development density, infrastructure, traffic management, building management etc) and the physical and mental well being of its citizens. Since data on the latter is often difficult to come by, observable factors that are known to have a direct bearing on human health conditions such as air quality, water quality, noise level, thermal comfort etc are used instead. The recent shift in emphases from an indoor assessment to a combined indoor-outdoor (built environment) assessment is essential for a more comprehensive analysis and understanding of the interaction of various factors.

The discovery of these theories requires knowledge from different fields and thus calls for a multidisciplinary approach. In addition, many recent

programs and tools for healthy city design also aim at resolving implementation issues. Resolving these issues is often the key to building a healthy city.

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