Science Plan on Health and Wellbeing in the Changing Urban Environment

A Systems Approach



ICSU
International Council for Science
Regional Office for Asia and the Pacific
Strengthening International Science for the Benefit of Society

About ICSU ROAP

ICSU Regional Office for Asia and the Pacific was inaugurated on the 19 September 2006 by the then Deputy Prime Minister of Malaysia, Y.A.B. Dato' Seri Najib Tun Abdul Razak. The new office will promote the development of science throughout Asia and the Pacific and help strengthen the voice of developing country scientists in this region. It will also ensure that its scientists become involved in those aspects of the ICSU 2006-2011 Strategic Plan that are especially relevant for the region.

Mission Statement

ICSU mobilizes the knowledge and resources of the international science community for the benefit of society, to:

- Identify and address major issues of importance to science and society
- Facilitate interaction amongst scientists across all disciplines and from all countries
- Promote the participation of all scientists in the international scientific endeavour, regardless of race, citizenship, language, political stance or gender
- Provide independent, authoritative advice to stimulate constructive dialogue between the scientific community and governments, civil society, and the private sector

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Preface

ICSU's new initiative on Health and Wellbeing in the Changing Urban Environment is of particular relevance to the Regional Office for Asia and the Pacific (ROAP) because the region is witnessing very rapid urbanization. For the first time in history more than half of its population live in cities rather than in the country side. The region is also actively designing smart cities to stimulate wealth creation and better lives for its peoples. Though cities are great places to live in they also impinge on human health. As the Asia Pacific region is home to a traditional concept of total wellbeing as opposed to mere cure for diseases it will be fertile ground for the acceptance of this ICSU initiative.

The ROAP established a Science Planning Group consisting of experts from the region in the fields of health, urbanization, design of cities and systems science, to produce a plan for the implementation of the ICSU plan on health and wellbeing in the changing urban environment. This science plan is the result of meetings held in Kuala Lumpur and China that examined urban life, health and disease profiles, all of which are rapidly changing and require novel integrated approaches towards improving policy-making and management of the new urban centres in Asia and the Pacific. Some case studies were developed on issues of regional importance such as informal settlements and mental health, to illustrate the value of the systems approach.

This Plan recognises the constraints due to diversity in income levels, culture, governance, capacity and most importantly availability of data for implementing a systems analysis approach in urban health planning and management in the region. Therefore, with a view to being relevant to both the developed and the less developed nations in the region we recommend a more nuanced approach to studies on health and wellbeing in the urban environment at the initial stages. While the countries that can engage in systems analysis can immediately initiate studies using the systems analysis approach, other countries should nevertheless begin to adopt approaches that highlight the complexity of interactions between the different determinants of health and wellbeing in the urban environment by using simpler influence models with the available data. Collaboration with established research groups and ICSU bodies should be encouraged for capacity building and the sharing of experiences. One or two cities may be selected as examples to demonstrate the utility of the systems approach for policy making. Close interaction of scientists with both policy makers and citizen groups is considered essential for the successful implementation of the Science Plan.

Indira Nath
Chair
ICSU ROAP Science Planning Group
Health and Wellbeing in the Changing Urban Environment

Executive Summary

The Asia-Pacific region is substantially urban, 45% of the population now resides in urban areas. Urbanization is increasing rapidly, with more than 40 million people being added each year. Moreover, 50% of these people are below 25 years of age.

The region faces the double burden of infectious diseases and the emerging life style diseases associated with rising incomes. The promise of greater opportunities in cities is accompanied by changing aspirations of people. Policy makers need to take into account the growing material aspirations of the people while planning developmental activities with improved environmental safe guards. Scientists have an important role in the development of new knowledge to inform this decision making. Total wellbeing involves complex interactions of multiple determinants, and systems approach can improve understanding of the interplay between these determinants and suggest practical approaches. Countries in this region range from developed (e.g. Australia, Japan, the Republic of Korea), to emerging economies (e.g. China, India) to low income nations. The region also has diverse governance systems varying from monarchies, socialist regimes and democracies. Combining this with differing expertise for undertaking complex analysis, we see that the approach to understanding the complex interactions involved in total wellbeing should vary throughout the region.

Acknowledging the diversity in expertise and data availability between countries, this plan strives for feasible and implementable approaches that could be initiated without delay. Capacity building would be developed around a major activity in the region where policy makers, civil society, scientists, administrators and people from informal sectors need to interact and understand the strength and weaknesses of each individual approach, and to see how that understanding improves through a systems process. Data collection and access will be essential for this analysis. A fast growing city and an institution will be identified in the first phase to initiate the systems thinking process.

New methodologies need to be sensitive and inclusive to be persuasive and successful. Both the people and the policy makers need to be brought on board early to translate systems research into action. The plan includes a number of case studies to illustrate the added value of systems approaches. The issues addressed in these case studies include transport, waste management, health consequences of informal settlements, and growth of new cities in the region.

Concurrently efforts should be initiated to identify international and regional collaborating centres that can execute a systems analysis approach and mathematical modelling on any of the issues identified above. It is anticipated that available funding will increase as the new paradigm is more widely recognised.

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Recommendations

Recommendation 1

The ICSU ROAP should
a) identify institutions in the region which are using at least a partial systems approach in work on urban health and wellbeing;
b) encourage these institutions, either individually or collaboratively, to take on a national and a regional role in building capacity in the groups identified above; and
c) assist institutions outside the region with the ability to build capacity in the region to do so.

Recommendation 2

The ICSU ROAP should, having identified institutions in the region which are using at least a partial systems approach in work on urban health and wellbeing,
a) encourage at least some of these to form the nucleus of a research team to undertake a model project;
b) bring this team into interaction with possible target cities for the model project;
c) bring this team into contact with potential funding agencies to support the research; and
d) collectively with the research team, the administration of potential target cities and funding agencies select one or two target cities as the basis of the project.

Recommendation 3

ICSU ROAP, with national members of the region, should use the exemplar studies as a base for an outreach program to convince the administrators and governors of cities in the Asia Pacific region to support the systems approach to health and welfare in urban regions, and to utilise them in their decision making.

Recommendation 4

ICSU ROAP through National Members in the region, assist national and city governments to conduct a public education campaign using print and electronic media and the internet, including social networking sites.

Recommendation 5

The ICSU ROAP should encourage ICSU National Members in the ROAP region, singly or collectively, to bid to host the International Programme Office of the ICSU interdisciplinary program on Health and Wellbeing in the Changing Urban Environment.

Recommendation 6

ICSU should ensure that the implementation of this ROAP Science Plan on Health and Wellbeing in the Changing Urban Environment is incorporated into the implementation of the ICSU Programme on Health and Wellbeing in the Changing Urban Environment.

02
Background

Introduction

Human health is identified in the ICSU Strategic Plan 2006-2011 as a new research priority, with the stated goal "to ensure that health considerations are duly taken into account in the planning and execution of future activities by building on the relevant strengths of Scientific Unions and Interdisciplinary Bodies".

To move to implement an ICSU role in the study of human health, a scoping group was set up, which reported in 2007, encouraging an involvement of ICSU in the study of human health, but noting that this involvement should not reproduce existing international processes. In 2008 ICSU set up a planning group to further this study. The report of the planning group, *Health and Wellbeing in the Changing Urban Environment: a Systems Analysis Approach,* An Interdisciplinary Science Plan will be presented to the 2011 General Assembly. In 2010 the ICSU Regional Office for Asia and the Pacific established its own Science Planning Group on *Urban Health and Wellbeing in the Changing Urban Environment: A Systems Approach,* with the following terms of reference:

Goal: To prepare a Science Plan on Health and Wellbeing in the Changing Urban Environment in Asia and the Pacific for the ICSU Regional Office for Asia and the Pacific (ROAP)

Scope of Work:

1. Review the current status of research, training and development in the field of health in the changing urban environment in Asia and the Pacific taking into account the ICSU Science Plan for Health and Wellbeing in the Changing Urban Environment as the foundation;

2. Identify specific additional considerations that should be emphasised for the Asia and Pacific Region;

3. Consider how the ICSU Plan might be implemented at the regional level and identify synergies with other ICSU ROAP priority areas/activities;

4. Define a set of priority research areas and the activities that can be promoted by ICSU ROAP;

5. Consider how the necessary scientific expertise and relevant stakeholders can be engaged;

6. Suggest fund-raising strategies and possible funding sources and partners for these activities;

7. Identify ways by which the results of the research in this theme can be made meaningful and more available to decision- and policy-makers, and other stakeholders in the region; and

8. Consider any other relevant matter critical to the successful implementation of the ICSU plan in Asia and the Pacific

The Science Planning Group met on 3 occasions. They identified the importance of working on health and wellbeing in the urban environment, agreed that the ICSU Regional Office for Asia and the Pacific had the possibility of playing a unique role linking the medical and other determinants of health and wellbeing. The concept of wellbeing was recognized as a key component of traditional holistic approaches to health and wellbeing in the Asia Pacific region, and it was realised that this would enhance the possibility of acceptance of recommendations based on this approach with the people and governments of the region.

After summarising the general situation in the region regarding health, which brings out the diversity throughout the region, the science planning group identified that a systems approach would provide a useful way to accommodate the very large number of variables relevant to the task of improving the health and wellbeing of the people in our region. Given the nature of the region, it was regarded that a systems approach rather than a more quantitative systems analysis approach would be the appropriate way to start studies in the region.

This study focuses on a small number of recommendations, in the hope that this will make the role of the ICSU ROAP in implementing the recommendations well defined. This of course leaves open the possibility that success in implementing the recommendations could lead to a more ambitious follow-up plan which has a wider scope

The Global Situation

For the first time in human history, more people live in cities than in the countryside. Globally, cities are now home to half of the world's 6.6 billion humans. During the next 3-4 decades, the UN estimates there will be 2-3 billion more urban dwellers. This means the urban population will grow by 1-2 million people every week. Once these people have been housed in cities, it is very difficult, and expensive, to retrofit transport systems and change land use. Now is the time for a rethink of our concept of cities and their place in the global environment.

Cities can be great places in which to live. People are attracted to cities for many reasons, including the availability of employment, education, social and cultural opportunities, and access to health care and other services. Urban ways of living affect health[1] in a variety of ways. Rapid and unplanned urbanisation leads to many environmental health hazards, including inadequate housing, overcrowding, increasing levels of air pollution, water shortage and pollution, poor sanitation and solid waste management, and increased incidence of motor vehicle and other injuries. However, well planned intensive cities produce lower carbon dioxide emissions than sprawling suburbs and in the long-term are likely to be more environmentally sustainable.

On average the health of people living in cities is better than people living in rural areas but such aggregate analysis masks urban health inequities. Within cities there is inequity in access to infrastructure and other resources (e.g. water supply, sanitation, housing, transport) which creates barriers to good health and environmental outcomes.

ICSU is currently considering the establishment of a new interdisciplinary science program on *Health and Wellbeing in the Changing Urban Environment: A Systems Analysis Approach*. This ICSU ROAP science plan aims to support the implementation of that science program in the Asia-Pacific region.

[1] The science planning group adopted the World Health Organization definition of 'health' – a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity.

Urbanisation in the Asia-Pacific region

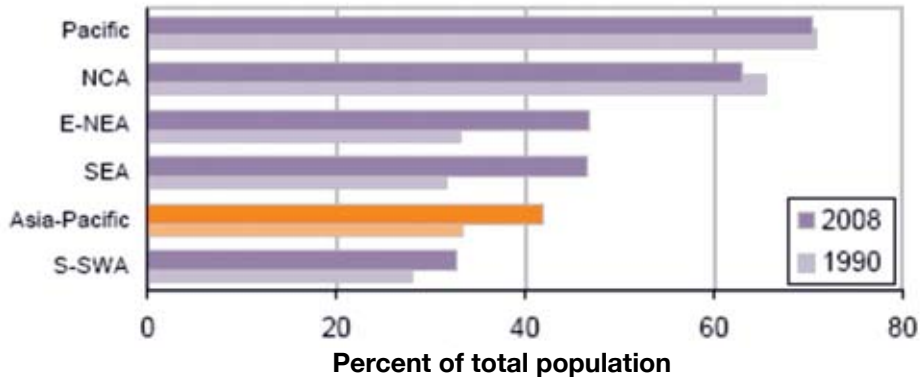
The Asia-Pacific region is urbanising[2] rapidly. Currently about 45% of the region's population lives in urban areas and the annual urban population growth rate is 2.3%. Across the region more than 40 million people are added to the urban population each year.

The urban population is growing more than twice as fast as the population as a whole – 2.3% per annum compared with 1%. This indicates that most urban population growth is due to rural-urban migration, along with reclassification of rural areas into urban areas, while a smaller proportion is due to natural population growth.

Within the Asia-Pacific region, the most urbanized subregion is the Pacific where over 70% of the population lives in cities and towns (Figure 1). However, within this subregion the level of urbanisation differs significantly between countries (Table 1). The highest levels are in Singapore at 100%, Guam at 95%, Australia at 89%, and New Zealand at 87%. The lowest levels – less than 25% – are in Micronesia, Papua New Guinea, Samoa, Solomon Islands, Tonga and Vanuatu.

After the Pacific, the subregion with the highest level of urbanisation was North and Central Asia (NCA). The least urbanized subregion – at 33.5% – was South and South West Asia (S-SWA), though Iran had levels similar to those in North and Central Asia (NCA), at 68%.

[2] This document is flexible as to the precise definition of 'urban', recognising that it refers to concentrations of people, resources and processes in relatively dense agglomerations which have come, by custom or statistical definition, to be called 'urban'. Although urban settlements may be classified as cities, towns and villages based on population size, the definitions vary between countries and in this document the terms 'urban' and 'city' are used interchangeably.



NCA - North and Central Asia
S-SWA - South and South West Asia
E-NEA - East and North East Asia
SEA - South East Asia
S-SWA - South and South West Asia

***Figure 1**. Level of urbanisation by Asia-Pacific subregion, 1990-2008 (UNESCAP 2009).*

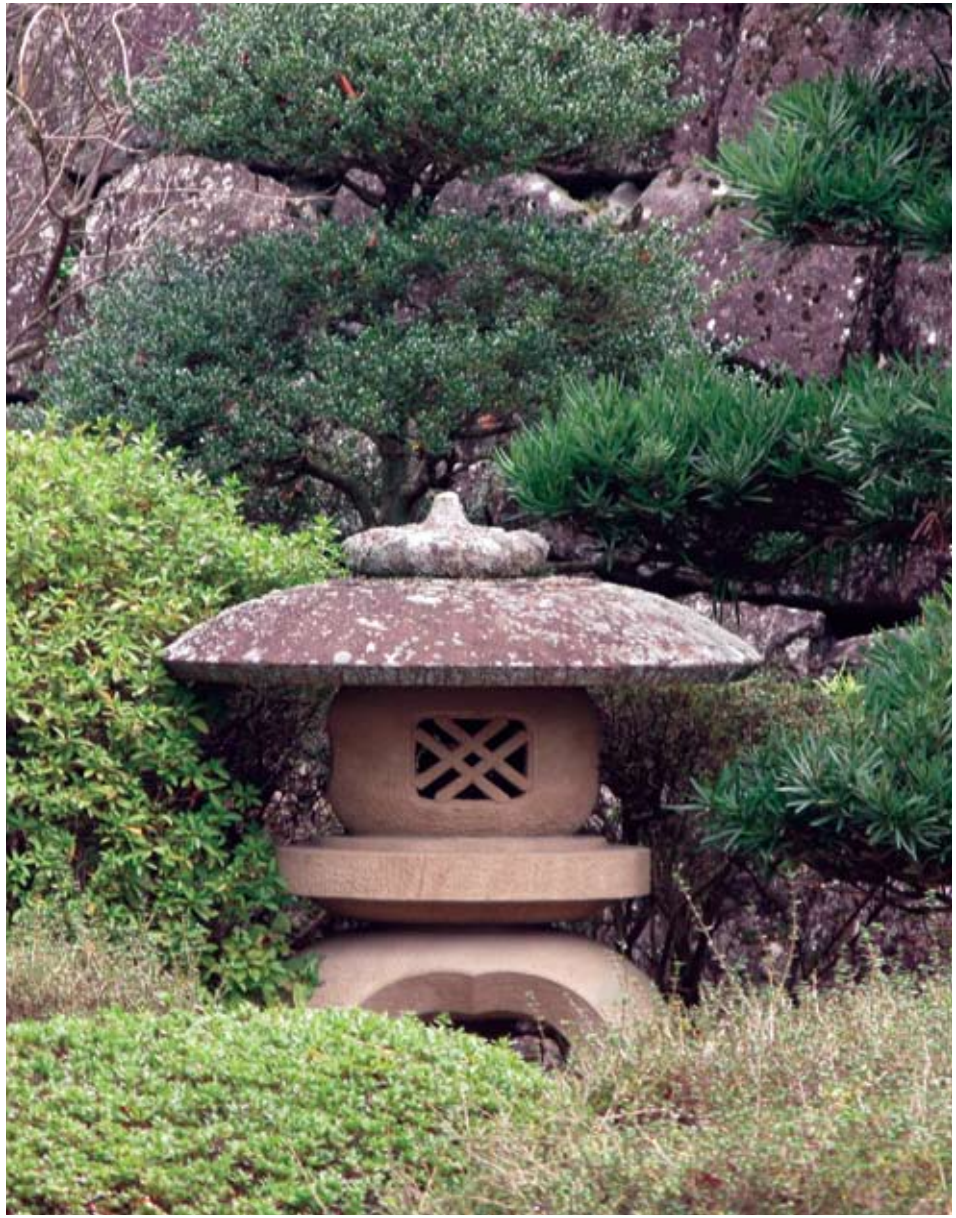


Table 1. Level of urbanization in Asia-Pacific and other countries. (UNFPA State of World Population 2007: Unleashing the Potential of Urban Growth.)

	Total population (millions) (2007)	Projected population (millions) (2050)	Ave. pop. growth rate (%) (2005-2010)	% urban (2007)	Urban growth rate (2005-2010)	Total fertility rate (2007)	% births with skilled attendants	GNI per capita PPP$ (2005)	Health expenditures, public (% of GDP)	External population assistance (US$,000)	Under-5 mortality M/F	Per capita energy consumption	Access to improved drinking water sources
World Total 6,615.9	6615.9	9075.9	1.1	50	2.0	2.56	62	9,420		-5,620,000	80 / 77	1,734	83
More developed regions (*) 1,217.5	1217.5	1236.2	0.2	75	0.5	1.58	99				10 / 9		
Less developed regions (+) 5,398.4	5398.4	7839.7	1.3	44	2.5	2.76	57				87 / 85		
Least developed countries (‡) 795.6	795.6	1735.4	2.3	28	4.0	4.74	34	1,427			155 / 144	306	
AFRICA	945.3	1937.0	2.1	39	3.2	4.71	47			1,623,468 [22]	155 / 143		
ASIA	3995.7	5217.2	1.1	41	2.4	2.36	58			633,053	64 / 66		
EASTERN ASIA	1540.9	1586.7	0.5	46	2.2	1.69	97				29 / 38		
China	1331.4	1392.3	0.6	42	2.7	1.73	83	6600	2.0	31879	30/41	1094	77
Democratic People's Republic of Korea	22.7	24.2	0.4	62	0.9	1.94	97		5.3	1,419	56 / 49	896	100
Hong Kong SAR, China (8)	7.2	9.2	1.0	100	1.0	0.95	100	34,670			5 / 4	2,428	
Japan	128.3	112.2	0.1	66	0.4	1.36	100	31,410	6.4	(442,186) [24]	5 / 4	4,053	100
Mongolia	2.7	3.6	1.2	57	1.5	2.23	99	2,190	4.3	2,277	75 / 71		62
Republic of Korea	48.1	44.6	0.3	81	0.6	1.19	100	21,850	2.8		5 / 5	4,291	92
SOUTH-EASTERN ASIA	570.2	752.3	1.2	45	3	2.33	69				49 / 39		
Cambodia	14.6	26.0	2.0	21	4.9	3.76	32	2,490	2.1	36,508	130 / 120		41
Indonesia	228.1	284.6	1.1	50	3.3	2.22	66	3,720	1.1	52,100	46 / 37	753	77
Lao People's Democratic Republic	6.2	11.6	2.2	21	4.0	4.33	19	2,020	1.2	2,733	129 / 123		51
Malaysia	26.2	38.9	1.7	69	2.9	2.65	97	10,320	2.2	4,131	12/10	2,318	99
Myanmar	51.5	63.7	0.9	32	2.9	2.11	56		0.5	10,739	107 / 89	276	78
Philippines	85.9	127.1	1.6	64	2.8	2.87	60	5,300	1.4	43,596	33 / 22	525	85
Singapore	4.4	5.2	1.2	100	1.2	1.30	100	29,780	1.6		4/4	5359	100
Thailand	65.3	74.6	0.8	33	1.8	1.87	99	8,440	2.0	10,291	26 / 16	1406	99
Timor-Leste, Democratic Republic of	1.1	3.3	5.5	27	7.0	7.39	24		7.3	3,562	118 / 110		58
Viet Nam	86.4	116.7	1.3	27	3.0	2.15	85	3,010	1.5	31,873	36 / 27	544	85
SOUTH-CENTRAL ASIA	1661.9	2495.0	1.5	31	2.5	2.92	39				87/90		
Afghanistan	32.3	97.3	3.5	24	5.1	7.11	14		2.6	15,257	234 / 240		39
Bangladesh	147.1	242.9	1.8	26	3.5	2.98	13	2,090	1.1	71,347	65 / 64	159	74
Bhutan	2.3	4.4	2.2	12	5.1	3.89	24		2.6	4,713	71 / 68		62
India	1,135.6	1,592.7	1.4	29	2.3	2.79	43	3,460	1.2	99,173	84 / 88	520	86
Iran (Islamic Republic of)	71.2	101.9	1.3	68	2.1	2.03	90	8,050	3.1	2,481	32 / 31	2055	94
Nepal	28.2	51.2	1.9	17	4.8	3.32	11	1,530	1.5	26,296	71 / 75	336	90
Pakistan	164.6	304.7	2.1	36	3.3	3.77	23	2,350	0.7	39,983	95 / 106	467	91
Sri Lanka	21.1	23.6	0.8	15	0.8	1.87	97	4,520	1.6	14,038	20 / 13	421	79
WESTERN ASIA	222.8	383.2	1.9	65	2.2	3.13	73			77079 [23]	56/48		
ARAB STATES (11)	335.0	598.5	2.1	56	2.8	3.40	67	5,199	2.5	157,296	54/48	1,472	75
EUROPE	727.7	653.3	-0.1	72	0.1	1.43	99				12/10		
LATIN AMERICA & CARIBBEAN	576.5	782.9	1.3	78	1.7	2.40	83			250,207	33/27		
OCEANIA	33.9	47.6	1.2	71	1.3	2.24	84				33/36		
AUTRALIA - NEW ZEALAND	24.7	32.7	1.0	88	1.2	1.78	100				6/5		
Australia	20.6	27.9	1.0	89	1.2	1.75	99	30,610	6.4	(49877)	6/5	5,668	100
Melanesia	7.9	13.2	1.7	20	2.5	3.51	61				73/80		
New Zealand	4.1	4.8	0.7	26	0.8	1.95	100	23,030	6.3	(3,979)	7/6	4,333	
Papua New Guinea	6.1	10.6	1.8	14	2.7	3.64	53	2,370	3.0	13,993	82/93		39
COUNTRIES WITH ECONOMIES INTRANSITION OF THE FORMER USSR (21)													
Azerbaijan	8.5	9.6	0.8	52	0.9	1.83	84	4,890	0.9	1,166	90/81	1,493	77
Kazakhstan	14.8	13.1	0.0	58	0.4	1.86	99	7,730	2.0	3,948	86/60	3,342	86
Kyrgyzstan	5.4	6.7	1.1	36	1.6	2.49	98	1,870	2.2	3,590	67/56	528	77
Tajikistan	6.7	10.4	1.4	24	1.1	3.39	71	1,260	0.9	2,469	116/103	501	59
Turkemenistan	5.0	6.8	1.3	47	2.1	2.52	97		2.6	1,277	104/85	3,662	72

Levels of urbanisation are closely linked to rates of economic growth. Higher levels of urbanisation are usually associated with more developed countries, where better economic opportunities and access to services in the cities attract migrants from rural areas. However, unplanned urban development can fail to provide adequate infrastructure and services to rapidly growing populations. For example, rapid urbanisation in many developing and least developed countries is creating a backlog of housing and physical infrastructure, and of economic, social and environmental services. This is manifest in the growth of slums and other settlements which are either un-serviced or under serviced. It is estimated that there are more than 500 million slum dwellers in the Asia-Pacific region. In some countries – Bangladesh, Cambodia, the Lao People's Democratic Republic, Mongolia and Nepal – a majority of the urban population live in slums.

The overflow of urban populations, land uses and functions beyond municipal administrative boundaries has major implications for the measurement of urbanisation levels and growth rates. Most countries in the region base their definition of 'urban' on administrative criteria. However, urbanisation levels and growth rates may be under-represented in official statistics because much growth is taking place outside such administrative boundaries.

The fact that urban regions increasingly transcend administrative boundaries creates new economic, social and environmental problems, requiring governments to re-think mechanisms and institutions for urban planning, management and governance. One issue, for example, is that these settlements are occupying rural areas that have lower planning and building standards, and more lax environmental regulations, resulting in haphazard developments that closely intermingle different land uses – industrial, residential, commercial and agricultural. Moreover, as they radiate along transport corridors, they take the form of 'ribbon' or 'strip' development that ignores large tracts of land further away from the main arteries. This can result in development that is environmentally unsustainable and resource intensive and has negative consequences for health and wellbeing.

Health trends and transitions in the Asia-Pacific Region

Infectious diseases, including pneumonia, diarrheal disease and tuberculosis remain a major health problem in many Asia-Pacific cities due to overcrowding, lack of safe water and sanitation, international travel and poor health-care access, particularly in urban slums.

Non-communicable diseases, such as heart disease, diabetes, cancers and chronic lung disease have also emerged as significant problems across the Asia-Pacific region, associated with changing dietary intake, reduced physical activity, and exposure to air pollution; all these health risks are more likely in urban settings. Mental health is affected by poor housing, overcrowding, noise, unemployment and poverty, leading to anxiety, depression, insomnia and substance abuse. Injury and violence is a third threat to health in many cities across the region.

The World Health Organization reports large differences in mortality rates across the Asia-Pacific region. In South-East Asia, 24% of deaths were of children aged under 15 years, compared with 8% in the low- and middle-income countries of the Western Pacific, where 67% of deaths were of people aged 60 years and older (Figure 2). The difference between the high-income countries and other regions is less pronounced for adult mortality than for child mortality.

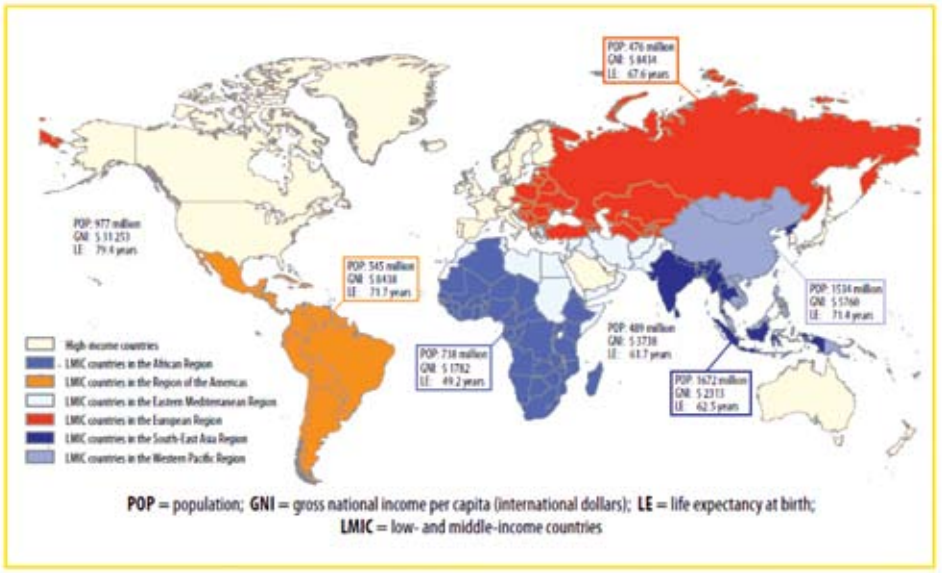


Figure 2 *Life expectancy at birth in relation to gross national income per capita and population in Asia-Pacific and other countries of the world (source: WHO 2004).*

Group I causes of death – which include infectious and parasitic diseases, and maternal and nutritional conditions – account for 29% of all deaths in adults aged 15-59 years in South-East Asia. In the South-East Asia Region, differences between male and female mortality were relatively small, with similar levels of mortality due to Group I causes, and somewhat higher mortality for men due to Group II (non-communicable diseases) and III (injuries).

The South-East Asia Region has 26% of the world's 58.8 million deaths in 2004, which is the highest proportion. The African Region has the next largest proportion (19%), followed by the Western Pacific Region (18%) and high income countries (14%).

However, the African Region accounts for 32% of all years of life lost (YLL), followed by South-East Asia (30%), the Western Pacific (13%) and the Eastern Mediterranean (9%) regions. Africa and South-East Asia have a high proportion of the global YLL because people from these regions die at a relatively young age. South-East Asia and the Pacific have a high incidence of infectious diseases, such as tuberculosis, lower respiratory tract infections, unsafe abortions, road traffic accidents and fire-related injuries and deaths, all of which increase the YLL.

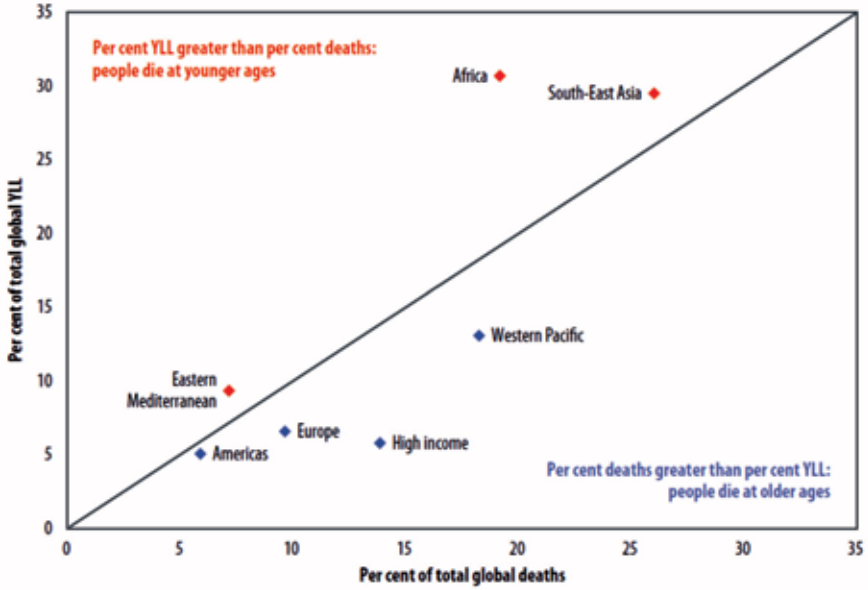


Figure 3*. Comparison of proportional distribution of deaths and YLL by region 2004 (source: WHO 2004).*

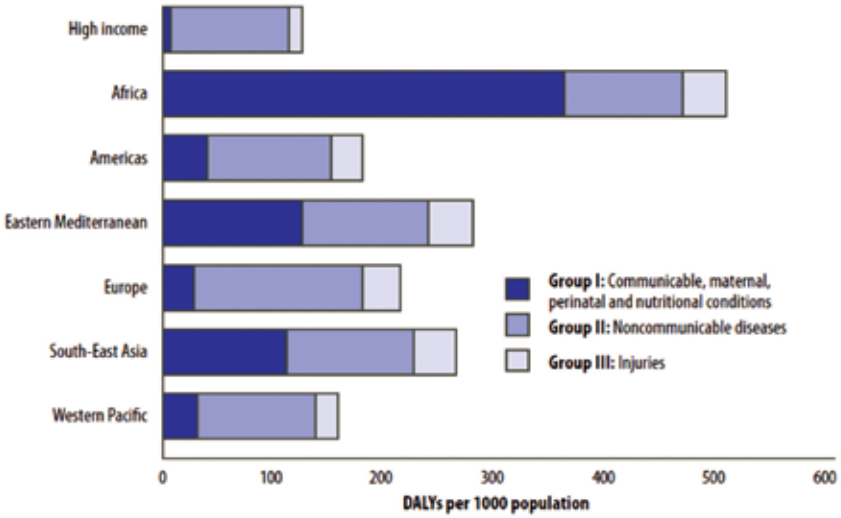


Figure 4. *Burden of disease by broad cause group and region. DALY (disability-adjusted life year) is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death" (source: WHO 2004).*

Global Change and Health and Wellbeing

Global change refers to planetary-scale changes in the Earth system consisting of the land, oceans, atmosphere, the poles, life on earth, the planet's natural cycles, and deep Earth processes. It also includes the large-scale changes in human society and as such global change research encompasses questions of urbanisation, globalisation, population, climate, the economy, resource use, energy development, transport, communication, land use and land cover change, biological diversity, ecosystem services, pollution, health and more.

The modern urban environment consists of combinations of areas of industrialisation, human habitation, business and office districts, and spaces for recreation and relaxation. These in turn impact on the urban environment affecting human health and wellbeing in a myriad of ways. Sometimes these effects are compounded by the concentration of poverty in the peri-urban areas that surrounds many cities in developing countries and in the inner urban areas of cities in the developed world.

With global change, vector-borne disease can spread from non-urban to urban areas through the migration of the rural population to informal settlements around the cities. Crowding and unsanitary conditions amplify the transmission of infectious diseases. Many such diseases thrive where there is a lack of potable water, inadequate drainage, poor sanitation and solid waste removal. There is also increasing concern that as global temperatures rise, mosquito-borne infections, such as malaria, will become more prevalent in highland cities in low-latitude countries, and in low altitude cities in high latitude countries. Recent movements of such vector organisms and their diseases to higher altitudes and latitudes may be an early response to climate change but causal attribution remains difficult because of the limited evidence. In recent years rainfall has also intensified as a result of global warming and more local flooding has occurred, facilitating the breeding of mosquitoes and causing microbiological contamination of sources of drinking-water even in urban areas.

The advance of dengue fever in tropical and subtropical zones has been aided by the expansion in urban areas of breeding sites for the *Aedes aegypti* mosquito. This disease is now the most frequently occurring vector-borne infectious disease in urban areas. The more recent spread (particularly via the international trade in used car tyres that contain mosquito eggs) of the second mosquito vector of dengue fever, *Aedes albopictus*, has increased the risk of infection in urban settings in several subtropical and warmer temperate zones.

With global warming the frequency and intensity of heatwaves in countries of Asia and the Pacific is likely to increase over the coming century. Those who are most vulnerable to heat-related illnesses and death are elderly people, those who are sick and poor people living in urban areas.

The impact of heatwaves on mortality is typically greatest in the centre of large cities, where not only do temperatures tend to be higher than in the suburbs and surrounding countryside but night-time cooling is lessened because of the 'urban heat island' effect caused by the large heat-retaining structures and treeless asphalt expanses of inner cities. The physical obstruction of cooling breezes exacerbates heat retention levels in urban centres. Although data on mortalities

and morbidity caused by extreme temperature events are common in developed countries, there is a paucity of reliable data on the effects of such extremes of heat and cold on urban populations living in the developing countries.

Global environmental change especially the effects of global warming and climate change can have severe health impacts in the rapidly changing urban environment. It is both the driver and the outcome of economic and social activities that are the basis of agricultural and industrial production and consumption systems that feed the urbanisation process in Asia and the Pacific. Viewed in this way, urbanisation is both a product as well as a driver of global environmental change, and in studies of human health and wellbeing in a changing urban environment, both processes (urbanisation and environmental change) need to be approached as a tightly interdependent system.

03

Taking A Systems Approach

Why a Systems Approach

As urban populations around the Asia-Pacific region increase in size and density urbanisation needs to be carefully managed if it is to enhance, not threaten, human health and wellbeing. To manage complex urban environments natural and social scientists around the region are initiating interdisciplinary projects focused on broadening our understanding of the operation of cause and effect in urban systems.

Sectoral investigations of these effects have been partially effective, at least in the short term. But, individuals whose beliefs about 'how the world works' are narrowly focused cannot reliably construct policies that will be effective in the medium- to long-term.

System science makes it clear that the behaviour of a complex system cannot be understood or reliably improved by studying the behaviour of its parts in isolation. Much better results are obtained when the system is viewed as a dynamic interactive whole. The major drivers of health and wellbeing in urban contexts arise from the links between social, cultural, economic, technological and biophysical factors in the larger human-environment system. Therefore, problems at the intersection of health and urban design must be studied in as broad a system context as possible.

The increasing complexity of urban systems has led to an awareness of the need for practical systems approaches. Such approaches range from simple 'systems thinking' methods, through conceptual models, to quantitative dynamical analyses. In practice all of these approaches are useful.

Systems thinking tools, such as the collaborative construction of influence diagrams, offer effective ways of integrating the different perspectives of the members of an interdisciplinary research group. These methods can also help generate the overviews of system structure that are essential prerequisites for more analytic methods. The process of model development, whether qualitative or quantitative, can help the modelling team to generate significant insights into system behaviour.

As is emphasised in the interdisciplinary science plan of the ICSU planning group on *Health and Wellbeing in the Changing Urban Environment: A Systems Analysis Approach*, mathematically based systems analysis is a simplified representation of the real world and cannot be expected to accurately predict the results of actions on a part of the system. Rather these models are developed to aid understanding and guide future actions.

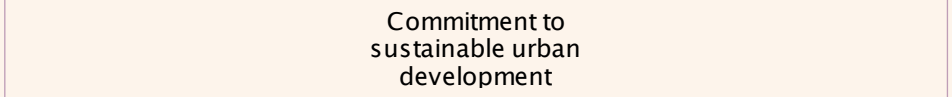
We are recommending a systems approach as a first step in implementing the systems analysis proposed in the ICSU report. We do so because we want to emphasise the complex interactions and understand how they influence the outcome. We believe that the mathematical systems analysis may be difficult to implement throughout the region at this point of time. The systems approach aids in understanding the links between various disciplines and the necessity to study the whole system to achieve desired outcomes. A systems approach can enable us to see the patterns of disease as well as factors promoting health and wellbeing that underlie these patterns, the so-called "causes of the causes". A systems approach can thus increase the effectiveness of research-informed policy, which can have unintended as well as intended consequences. Progress requires the involvement of policy makers and the general public in systems thinking, to persuade them to realise that sectoral interventions in complex systems can have unexpected outcomes.

Influence Diagrams

Influence diagrams are effective for developing initial hypotheses concerning interactions between the key variables of a complex system. Box 1 illustrate the step-wise development of an influence diagram representing selected interactions between governance standards and urban health and wellbeing. In these diagrams the blocks of text represent system variables and the arrows represent cause-and-effect links.

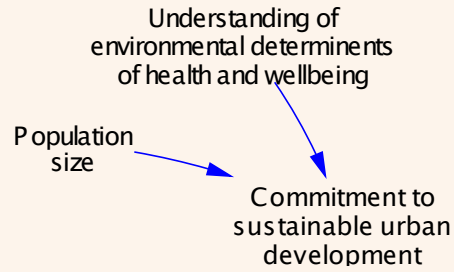
The steps in the construction of an influence diagram are illustrated in the Box 1. The first step, is to select a focus variable whose value plays a key role in relation to the problem or issue of concern. Then add selected variables that affect the value of the focus variable, keeping the number of variables low in an attempt to isolate those influences that are believed to play a dominant role. Next include a small number of variables that are affected by changes in the value of the focus variable. Now add influence links that identify possible feedback loops between the selected variables. It may be necessary to include additional variables at this stage. Both of these actions are illustrated in the final step in Box 1. Following this procedure enables us to identify the interactions between the variable which enter the problem we are trying to address, and helps us understand the complexity of any attempt at its solution.

Box 1. Steps for the Systems Approach



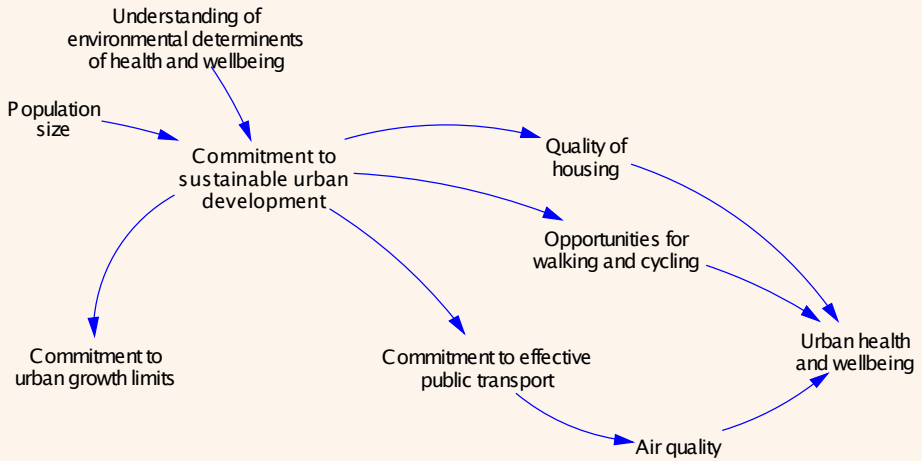
STEP 1.

Select a focus variable whose value plays a key role in relation to the problem or issue of concern. In this example the focus variable 'Commitment to sustainable urban development' measures the extent to which those involved in urban governance are committed to long-term improvement of the urban environment and living conditions.



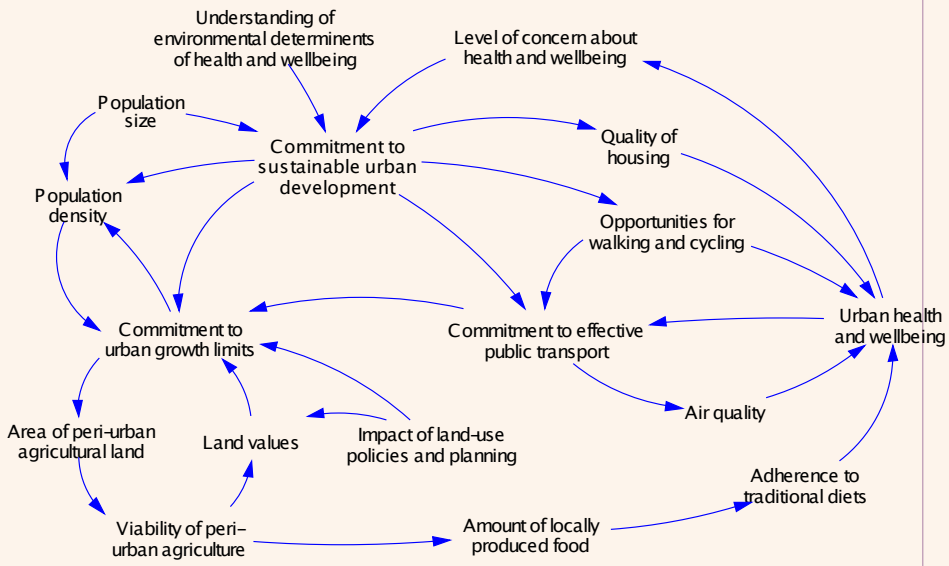
STEP 2.

Add selected variables that affect the value of the focus variable. Keep the number of variables low to encourage efforts to isolate those influences that are believed to play a dominant role in the problem or issue of concern. The two affecting variables selected here highlight the influence of increasing population, and the critical importance of understanding the effect of environmental factors on urban health and wellbeing



STEP 3.

Add selected variables that are affected by changes in the value of the focus variable. Once again keep the number of variables low to emphasise the influences that are considered to be most important. The focus variable is assumed to affect 'Urban health and wellbeing' via the intervening variables 'Opportunities for walking and cycling' and 'Quality of housing'. The variable 'Commitment to urban growth limits' measures the extent to which urban decision makers wish to contain urban sprawl. The variable 'Commitment to effective public transport' measures the extent to which there is a focus on developing public transport systems that are matched to the needs of the urban community. This variable is assumed to have an effect on 'Urban health and wellbeing' via its effect on 'Air quality'.



STEP 4.

Add influence links that identify possible feedback loops between the selected variables. It may be necessary to include additional variables at this stage. In the example shown here the variable 'Level of concern about health and wellbeing' has been added as a part of a new feedback link from 'Urban health and wellbeing' to 'Commitment to sustainable urban development'. Also, in the lower left-hand corner of the diagram, a new structure has been added to represent the effect of an imposition of urban growth limits on population density and the viability of peri-urban agriculture. This structure draws attention to the issue of the influence of land-use policy and planning, and the effect of a viable peri-urban agriculture industry on urban health and wellbeing via its impact on diet .

Insights from systems science make it clear that policies developed on a sectoral basis may suffer from 'policy resistance'. Policy resistance occurs when the implementation of a policy causes changes which may undercut the aims of the policy itself. In a very real sense the system 'fights back' to oppose the intended change. For example, policies that promote increased affluence would be regarded by most people as a positive contribution to a community's wellbeing. But, increased affluence can lead to behaviours that reduce community health. Such behaviours include the substitution of motor vehicles for walking and cycling, and the consumption of greater quantities of high-calorie food. While it is extremely difficult to completely avoid policy resistance it can be reduced significantly by adopting a systems approach.

System science has now developed to the point where it can support efforts in integrative research and policy making. It can help decision makers to avoid policy resistance. It can help identify system leverage points, where small actions can produce large effects. Such work requires investment of time, intense sustained dialogue, and idea analysis. But the effort is both necessary and effective to promote health and wellbeing.

Applying Systems Science to Health and Wellbeing

There are many ways of measuring health problems and the burden of disease in cities and regions, including life expectancy, disability adjusted life years or years of life lost. We can draw on previous research to identify the differences between the South East Asia and Pacific regions compared to other regions of the world, by ranking the major causes of diseases and identifying vulnerable populations. However, knowledge of the causes and consequences of diseases does not always provide methods for improvement of wellbeing. On the other hand focusing on the social and economic determinants of health enables us to identify the systemic links in urban society and the points where research can highlight possible policy interventions.

An understanding of the universality of human health needs is useful in analysing health impacts of urban ways of living. Box 2 contains a list of some universal physical and psycho-social health needs.

Box 2. Universal human health needs[3]

Physical
Clean air
Clean water
Natural* diet
Absence of harmful levels of radiation
Minimal contact with pathogens
Protection from extremes of climate
Noise levels within the natural* range
A natural amount of physical activity
Sleep

Psycho-social
An emotional support network
The experience of conviviality
Opportunities for co-operative behaviour
A natural* level of sensory stimulation
An interesting biodiverse environment
An aesthetically pleasing environment
Opportunities for creative behaviour
Opportunities for learning
Opportunities for recreation
Opportunities for spontaneity
Variety in daily experience
A sense of belonging, purpose and love
Absence of alienation and deprivation

* As nature intended

[3] The selection of items for this list is based in the evolutionary health principle (Boyden, 2004).

04

Cross-Cutting Issues

Diversity of Cities

There is a diversity of urban histories across the region – cities like Varanasi, which have been in place for many millennia, colonial cities such as Shanghai that are two centuries old, and new cities such as Shenzhen that are less than three decades old. The political and economic histories are equally diverse, ranging from tribal trading centres to modern mega-cities that drive the world economy.

Many cities incorporate formal and informal settlements, which lead to people in the same city living under different organisational rules. Some cities are governed from a central government, other cities are more or less autonomous, both in the revenue they raise and the direction they take. In some informal settlements local people take decisions as to how their community is organised. National policies and arrangements for revenue have an impact on housing and transport policies. In some cities, this is considered national infrastructure, in others money has to be raised locally, from public or private sources.

Cities have higher population densities than the surrounding areas and attract migrants from rural areas and poorer neighbouring countries seeking employment and greater opportunities. Many cities are located on sea and land trading routes. Cities that are the confluence of many trading routes, such as Hong Kong and Singapore are strong economic hubs, that have developed strong capital markets. Others such as Suva, which hosts the University of the South Pacific are hubs for capacity building in the surrounding Pacific Islands.

Size of Cities

The size of cities are directly related to the services they provide and drives the efficiencies of agglomeration, but larger cities also can have complex health problems. As cities increase in population and physical size, there is a need to develop additional centres of business activity and services – the so-called polycentric cities.

However, agglomeration can lead to increasing income inequality as formal employment opportunities may become increasingly scarce. In many cities there has been a rapid growth of squatter settlements as new settlers move to more affordable and accessible areas on the perimeter. Changing industrial patterns can lead to impoverished areas inside the city as employment leaves the area.

Building on Current Knowledge

Substantial improvements in health across the Asia and Pacific region during the last century have been driven by improvement in water, sanitation, housing and public transport systems. Traditional science disciplines – physical, health and social – have generated specific knowledge about health problems, substantially from a biomedical perspective. Vaccination and antibiotics have reduced the burden of infectious diseases. Further improvement to health and wellbeing in the increasingly urbanised region will require a more systemic approach to problems, going beyond the now usual disease-specific manner.

Indigenous views of health and wellbeing were holistic and linked the health and wellbeing of the individual with that of the local environment. The Asia Pacific region has been rich in traditional wisdom as exemplified by the well documented centuries old Ayurveda ('wellbeing' in Sanskrit) of India and the Chinese system of medicine. The environmental principles of habitat had been enunciated a long time ago by Vaastu and Fengshui systems in India and China respectively. With advent of industrialisation much of this was corrupted or forgotten. The need to restore the close interconnections between man and the changing environment has driven India to provide free access to a digital library of the prescriptions of Ayurveda and to promote its understanding in the context of current thinking.

The new approach to tackling problems does not simply draw on different disciplines, but acknowledges local and traditional knowledge and frames issues systemically. For example when housing for working people is built on the outskirts of cities, beyond the urban limits, the need to travel into the city centre for work, not only increase travel time but also cause deprivation of sleep. Moreover, transport would generate carbon dioxide and other harmful emissions and thereby add to air pollution and global warming.

Policies to mitigate climate change and carbon dioxide emissions requires the generation of critical new knowledge using integrated systems approach. If we want to improve the health of city dwellers, we need to think about the co-benefits of having more compact, or polycentric cities connected by fast public transport, where decent affordable housing is closer to work and amenities can be reached by walking, cycling and public transport, rather than private motor cars.

Applying the Systems Approach

The systems approach re-emphasises the interconnections between the social and physical worlds that were highlighted originally by communities whose understanding of human health and wellbeing was grounded in local knowledge. In the current world participation from both local communities and policy makers is a critical element of a systems approach and a variety of research methods are useful as indicated in the case studies described below.

Reliable data are essential for the understanding of the existing situation and how it is changed following various interventions as is emphasised in the ICSU report. Data are the most important components of any systems analysis or systems approach. In some cases this can be obtained by mining existing datasets, as long as access is available. In others, new data may need to be collected. In addition, integration of data sets and systems will be necessary to understand the links that become more apparent when one adopts a systems approach


東京90km
Tokyo
横浜58km
Yokohama
平塚24km
Hiratsuka

05

Case Studies

In this chapter, we have included six case studies that have been selected to illustrate and highlight the advantages of adopting a systems approach to address issues on urban wellbeing. In each case we have represented the major elements in the form of a systems diagram, before briefly describing the research that has been undertaken, planned or proposed.The six case studies are: informal settlers in the formal city structures; increasing integrated public transportation; economy, development and urban health and wellbeing; health consequences of social and economic change in Japan and Korea; the link between housing and health; public-private partnership in the disposal of waste in the Philippines.

Informal Settlements in South-East Asia

Background

One billion out of nearly three billion urban people were slum dwellers globally in 2000; in Asia 40% of the urban population lives in slums. The Millennium Development Goals explicitly focus on an integrated approach to slum upgrading on health and economic grounds. The per capita cost of upgrading slums is almost twice the cost of providing new affordable housing initially.

The defining characteristics of slums are the absence of basic facilities in houses; illegal or poor building structures; overcrowding and high density; lack of basic services; inadequate access to sanitation and other infrastructure; inadequate access to safe water; hazardous locations; insecure tenure; and poverty leading to social exclusion. Slum neighbourhoods are less likely to have basic infrastructure and social services, such as schools, dispensaries and recreational facilities. Slums, which by definition are unplanned and often built in low-lying areas or on unstable slopes, are more vulnerable to natural hazards and disasters.

To improve health and wellbeing in the slums, we need to have interventions that reduce urban poverty as well as improve the housing and lack of amenities associated with slums. People living in slums are socially and economically deprived and have inadequate and unstable assets, and limited social safety nets. Moreover, slum dwellers have inadequate protection of rights through the operation of the law and often lack 'voice' and power within political systems and bureaucratic structures.

In many areas of South East Asia the rural landless poor, who move to urban areas are not recognized as city administrators. Rural migrants, despite contributing to the urban economy, can be totally excluded from the large social movements of urban workers seeking equity in the form of basic amenities and services.

Yet slums are also centres of resourceful people with aspirations, voting power and abilities to create wealth for the city in the form of small scale industries and manufacturing. This is exemplified in Dharavi in Mumbai, India where exported products are manufactured in this area. It is a living entity which makes it a city within a city. Such slums have informal and working local governance systems to maintain orderliness.

Case study

Successful local solutions through collaborative global networks create a communication channel that enhances the opportunities for advocacy. An example of how global advocacy groups can improve health comes from Mumbai, where a network of community leaders from informal settlements and women's collectives, addressed the problem of dangerous roofing materials such as discarded asbestos sheets. Asbestos generated illnesses and construction related accidents were both reduced by introducing innovative, affordable, flexible prefabricated construction roofing tiles called Laadi, made of sandstone and cement.

Research

It is important to describe and analyse the success factor in grass-roots organisations, particularly those that can have an impact locally, set an example regionally and internationally. Future research opportunities include qualitative case studies that can describe the social organisations of such groups and how they overcome local barriers and develop their communities through collective action. The inter-related actions of individual slum dwellers, civil associations, NGOs, municipal and national governments, the private sector, and the international community do not all have equal power or leverage, but all need to be included in a systems approach to urban management.

This systems influence diagram highlights a number of intervention points for improving health and wellbeing (Figure 5). Economic development in rural areas can reduce urban migration and the number of people living in slums. Legalising slum dwellers as urban citizens and legally supporting them to improve their dwellings and accumulate assets can also increase their opportunities for getting formal jobs and improving their children's education. Participation in local organizations and commercial entities can help to increase social cohesion and material living conditions of the slum dwellers and also create wealth for the city.

Outcomes

Following the experience in Mumbai, collectives of pavement dwellers in the Philippines and Kenya sought dialogue with local and national governments to map out communities vulnerable to flooding and to seek policies that are community-managed and community-driven

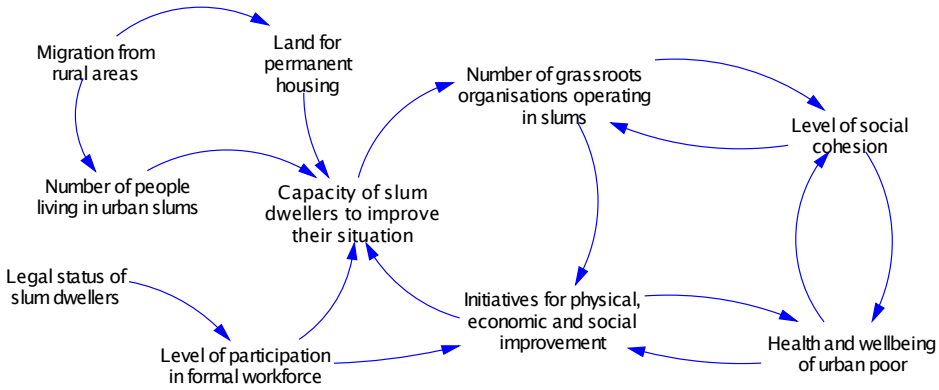


***Figure 5**. Systems approach to factors that affect the capacity of slum dwellers to improve their health and well-being*

Integrated Public Transport

Background

Walking and cycling are healthy ways to travel and bring substantial health benefits through increased levels of physical activity. Regular walking and cycling reduce weight gain and deaths from cardiovascular disease, breast and bowel cancer, and the risk of depression and anxiety.

Greater car use tends to result in less health-promoting physical activity more vehicle emissions and increased probability of vehicle related injuries. Motor vehicles emit pollutants such as nitrogen oxides, particulate matter and carbon dioxide.

Case study

In many Asian and Pacific countries, the proportion of the population using walking and cycling, as means of transport is smaller now than it has ever been. In Asia, increased government investment in roads and a rapid increase in car ownership have been encouraged to promote economic growth. This urban planning has led to increasing urban sprawl, with commuters travelling increasing distances to work. However, many urban governments have also become concerned about the effects of traffic congestion on the health and wellbeing, as well as the costs of traffic injuries and lost productivity. As a result of these multiple and interconnected problems, there is growing investment in public transport systems, with more intensified housing being built around public transport nodes, and a gradual move back to encouraging active travel modes.

Research

We know from previous research that it is difficult to change behaviours in highly car-dependent societies, but recent systematic reviews have shown that community-wide promotional activities in conjunction with improving infrastructure for cycling may increase cycling by modest amounts. More work however needs to be done, and studies are required for precise measures of travel activity, with a focus on areas with, and without, an established cycling culture. It is also important that the infrastructure is improved in poor and middle-class areas, to avoid inequalities in health.

Joint research is being planned in several Asian and Australasian cities to explore effective methods to increase the levels of cycling and walking. On-going discussions are being held by transport researchers, and public health researchers from the New Zealand Centre for Sustainable Cities and the Australian Urban Research Centre, with non-governmental organisations in Beijing, where despite traditionally high levels of bicycling, current usage has dropped precipitously. A comparative community trial in several cities is being designed to evaluate the outcomes of cycling and walking infrastructure on several outcomes. Funding is being sought from national as well as international research funders.

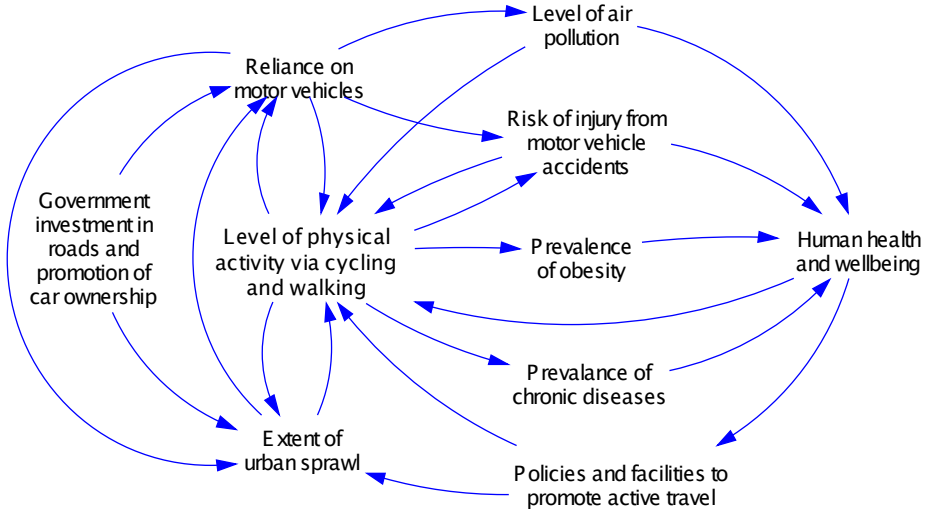


Figure 6. *Systems influence diagram of factors that determine level of physical activity and its relations to urban health*

Outcomes

The expected outcomes are improved understanding, reliable data and measures relating to interventions for improvement in health and wellbeing, reduction in vehicle related injuries and decrease in carbon foot print.

Changing modes of transport is one of the keys to urban health both in the short and long terms (Figure 6). Comparative intervention studies are an important way to demonstrate effective, cost-beneficial policies that could be implemented more widely.

Economy, Development and Urban Health and Wellbeing

Background

A good economy is the base of urban health and wellbeing. Strong industries and rapid economic growth lead to adequate employment and finance allowing individuals to afford more personal health care, and governments to devote more funds for public good. This is especially important for developing countries, where existing finances are insufficient to cater for the whole society (Figure 7).

Case Study

The city of Shenzhen is the first and most successful Special Economic Zone (SEZ) in China. It was founded in 1979 at the beginning of the Chinese Reform, and turned from a fishing village into a world-famous metropolis in three decades. Since 1980, Shenzhen has been identified as a possible site for developing an export-oriented economy, and attracted large amounts of foreign investments. Its economy initially hinged on outward processing and manufacturing but has since been upgraded towards high-technology industrial investments. Through the introduction of the nation's first land market in 1987, the municipal government increased its revenue, phased out those traditional and low value-added industries, and accelerated the economic restructuring process. High-technology industries in Shenzhen have experienced phenomenal growth with the establishment in 1996 of facilities that sponsor high-tech corporations seeking loans. Since then many local high-technology companies have gained global competitiveness, e.g. Huawei, ZTE, BYD, and Tencent.

The unintended consequences of the policies have been the 1) increase in the city population from 0.31 million in 1979 to 12 million in 2009. 2) High density industrial and housing development to cater for the marked population growth changed the landscape of Shenzen from that of a small village to modern industrial zones and high density housing. Nevertheless, beyond the municipality area, previous land owners who were largely farmers built "urban villages" that catered for the housing needs of the floating labour force. The buildings in these "villages" are lacking in public amenities including schools and health clinics. 3) Land for food cultivation and clean water became scarce.

To alleviate these problems measures have been taken to promote the adoption of the philosophy of a harmonious society-economy-nature relationship in Shenzen. i) Large investments have been made improve medical services and schools. ii) Social security has been enhanced and pollution of rivers has been abated. iii) The coastal ecosystem has also been rehabilitated and restored. These measures have turned Shenzhen into a well-rounded first-class city comparable to Shanghai and Beijing. It is currently aiming to become a world class city with a strong service economy. This illustrates the need for constant monitoring and policy changes for the maintenance of urban health in consonance with economic growth.

Research

A systems approach was used to understand the interconnections between economic development and urban wellbeing as shown by the system influence diagram below. The main driving force of this system is the special economic policies, under which a substantial amount of investments were acquired and used. When industries began expanding, the required infrastructure was established, driving further growth of the economy. Economic growth stimulates population growth and land development, that brought challenges to the city. The municipal government is required tot take the initiative to ensure that the developmental activities led to a harmonious society-economy-nature system that guaranteed urban health and wellbeing.

Outcomes

The Shenzhen example illustrates the importance of a systems outlook in economic development that has the ability to ensure that health and wellbeing in rapidly developing urban areas develops in harmony with all the other aspects of societal development.

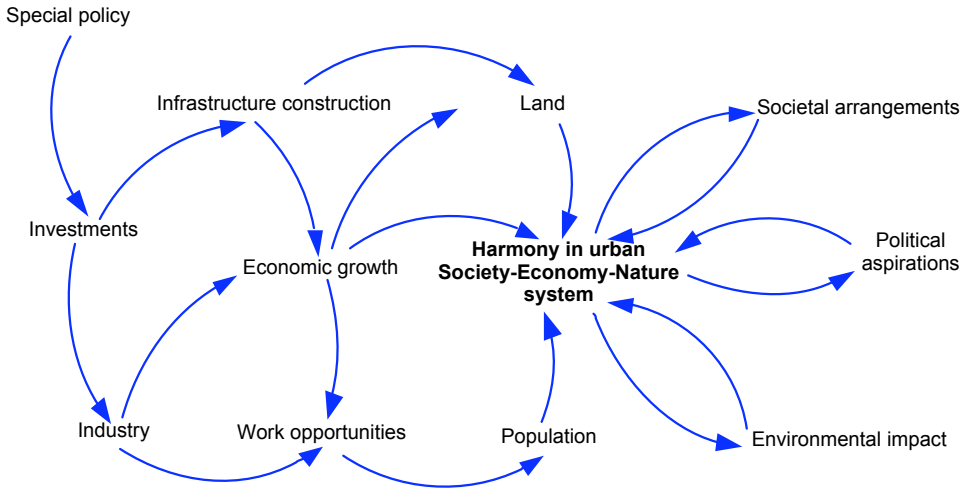


Figure 7. *Systems influence diagram of factors that determine level of physical activity and its relations to urban health*

Health Consequences of Social and Economic Change in Japan and Korea

Background

Rapid urbanisation and economic progress in Japan and Korea, which share a social and cultural background, is leading to unintended consequences such as clinical depression and high suicide rates among school children in Korea and among the working and aged populations in Japan.

Interventions to improve work-life balance for the workers and social support for the children and the aged require a systems type research which could be used to inform policy making.

Case Study

Some identifiable causes of work related stresses include the socio-economic perturbations such as the world-wide recession in 2008, increase in the relative poverty rate, and job insecurity. The increase of the relative poverty rate in Japan is second to the USA since 2006. The number of part-time and contract workers increased from 19.7 % in 1987 to 36.5% in 2007. Gender differences are apparent with male: female ratios for full-time workers being 100:70 and for contract employees 57:42. Moreover, the income gaps between men vs. women, and part-time vs. regular workers are the highest among OECD countries. From 1999 to 2007, suicides caused by over work increased 6 times with 63 % being white collar workers and 56% being in the productive age group of 20-39 years. Long working hours (as high as 52.5 hour/week, or 2700 hours/year, in Japan) among full-time workers are common in Japan and Korea.

The deterioration of the work environment combined with job insecurity causes severe stress for working parents with consequences for children. Poverty is associated with one third of child abuse cases. 70 % of single mothers earn less than 200 million yen, which is half of the national median level of income. A recent governmental survey of 70,238 Korean school children showed 38.8% of middle school and high school students suffered continuous depression, Of these 18.9% intended suicide and 4.7% actually committed suicide in the last year alone. Depression and the intended suicide rate in Seoul was the highest (40.5% and 20.1%, respectively).

The size of the aged population is another matter for concern. In Japan the greying society was 23% in 2010 and is expected to rise to 30% by the 2025 because of longevity (82.3 yrs. and 77.9 yrs. in Japan and Korea, respectively) and low birth rate (1.27 and 1.22. in Japan and Korea). Korea is also facing a aging population and China will soon follow suit due to the one-child policy. Aging is more rapid in the urban than in the rural areas. Moreover, social cohesion is threatened due to smaller housing which makes it difficult for the generations to live together as in earlier times. The urban elderly tend to become more isolated than their counterparts in the rural area because of the rapid influx from rural to urban, deteriorating social network and lack of community support. The Tokyo study showed that care giving has beneficial effects as those who provide support to others have lower risk of death. Intervention by inter-generational interactions promotes intellectual activity to a higher level.

Research

The economic benefits that accrue from happy citizens cannot be underestimated. How to achieve decent ‘work for all’ as recommended by ILO including a suitable work-life balance has crucial dimensions that need to be identified for each culture and age. The notion of “Productive Aging” or “Active aging” is an important approach towards preventing depression and earlier death of the elderly. More community oriented intervention studies are needed to clarify preventive factors. The conceptual framework for considering the multiple factors that contribute to mental wellbeing in the urban setting is given in the ICSU report on health and wellbeing in the changing urban environment Some of the determinants are work related stresses, economics of contract and permanent staff, gender related inequities, housing constraints on mental health and wellbeing would require to be investigated in a culturally sensitive manner. The social acceptance of humanoids that clean the floor, wash clothes or cook but also read, sing and talk with the elderly needs to be considered as Japan is the first country that is exploring this technological innovation to help the aged.

Outcomes

It is expected that better social structures would emerge that incorporate the sensitivities of the people with economic development and a sustainable culture (Figure 8).

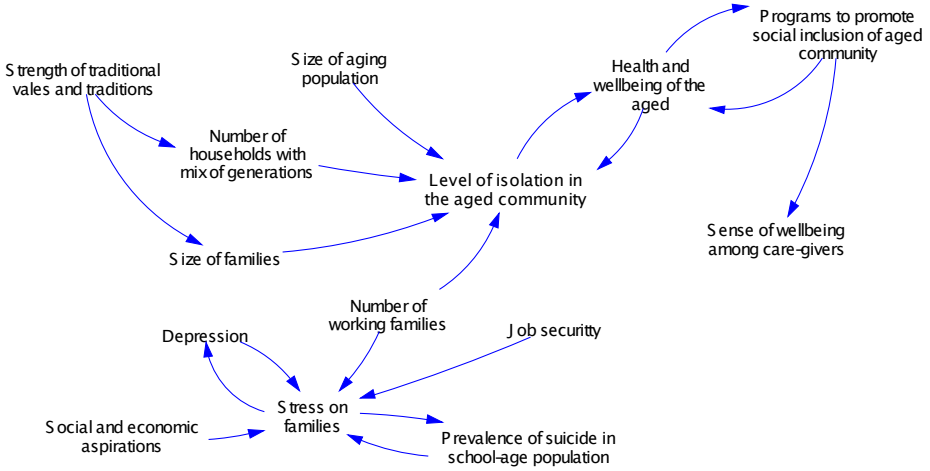


Figure 8. *Systems influence diagram showing the health effects of isolation in the aged community*

Housing and Health

Background

Regardless of climate, people in urban areas spend most of their time indoors, so exposure to the indoor environment is crucial for health and wellbeing. As oil prices are rising, the cost of fuel to cool and heat our houses is becoming more problematic. Most permanent housing that will exist in 2050 has already been built, so improving housing, through retrofitting existing houses is as important as developing and enforcing building codes.

Case Study

In New Zealand, a community trial the *Housing, Insulation and Health Study* was incorporated in the national energy efficiency programme. The study was designed by a multi-disciplinary research team led by public health researchers, to look at the impact of retrofitting ceiling and under-floor insulation on health, wellbeing and carbon mitigation. The design was a staggered intervention trial where all households were randomised to an intervention or a control group. All household members collected data in 2001 and then the households in the intervention group received retrofitted insulation before the follow-up measures were taken in 2002. After these follow-up measures were taken, the control group houses were insulated.

The study was set up in consultation with local communities, energy providers and policy makers and involved 13,500 households and nearly 5,000 people over two years. Self-reported health, school attendance, and independent measures of temperature, relative humidity, electricity consumption and health services utilisation were collected.

Research

The cost-benefit analysis, which showed that the summary of benefits of the retrofitted insulation outweighed the costs by nearly two-to-one, were instrumental in leading to local and central governments to invest in residential retrofitted insulation programme. The policy is currently being rolled out across the country and this implementation is also being evaluated (Figure 9).

Important policy initiatives can be seen as 'natural experiments', which can provide lessons about what works and what does *not* work in improving urban health and wellbeing in both the private and public sector. Academics, working with local communities, national policy makers and private companies, design community trials to show the causal effect of policies on many different parts of the urban system, including health and wellbeing. These trials identify the links in the systems approach and could provide data for further analysis.

A well-planned housing intervention can affect the occupants' health and wellbeing, as well as having broader system benefits by reducing the demand for energy and contributing to the mitigation of carbon dioxide emissions. During an economic recession, housing improvement programmes can also generate employment. The New Zealand experience is informative to other countries and the WHO Housing and Health Guidelines.

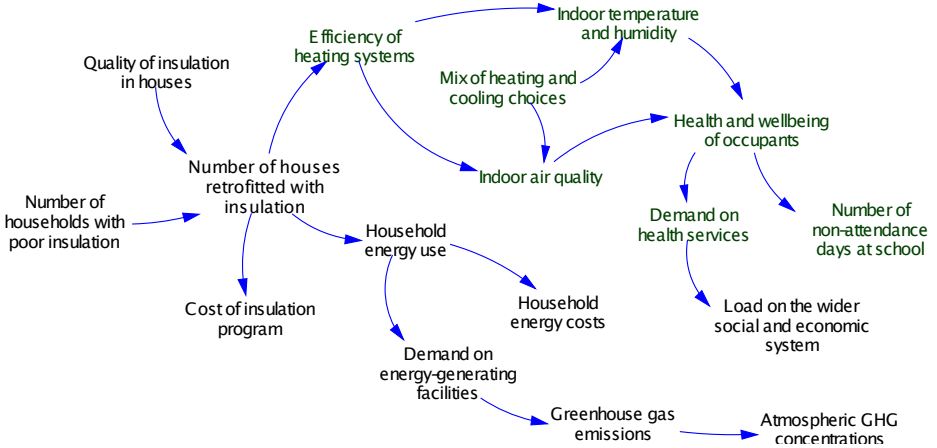


Figure 9. *Systems diagram of the impact on health and wellbeing and energy efficiency of retrofitting insulation in existing houses.The focus variable in this case is the number of houses retrofitted with insulation. This affects household energy use, as greater thermal mass in the house means less energy is used to heat or cool the house and consequently less carbon dioxide is emitted. Keeping temperatures in the indoor environment within a moderate range maintains the health and well-being of the occupants and lowers health care and other social costs.*

Outcomes

People in the intervention study reported better health and spent less on their electricity than in the control groups. Children had fewer days off school and people reported better mental health. There was also trend for people in the intervention group to have fewer hospitalisations.

Public-Private Partnership in the Co-Processing of Waste in the Philippines

Background

Incineration as a process of waste management has drawn much controversy. Polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) may be formed from the raw materials as unintended by-products from chlorine and hydrocarbon precursors. In addition, greenhouse gases are generated.

Exposure to dioxins, furans and co-planar PCBs may lead to adverse health effects. Long-term, low-level exposure of humans may lead to impairment of the immune system, the developing nervous system, the endocrine system, and reproductive functions. Short-term, high-level exposure may result in skin lesions and altered liver function. Exposure of animals to dioxins has resulted in several types of cancer.

The formation of dioxins and furans is known to occur by de novo synthesis during cooling within the temperature range from 450ºC to 200ºC. Under some circumstances, including when wastes are incinerated at low temperatures, or when plastics containing polyvinyl chloride (PVC) are incinerated, dioxins, furans and other toxic air pollutants may be emitted. One promising solution is to burn the wastes as fuel in cement manufacture. In cement kilns fuel is burnt at temperatures up to 2000ºC in a turbulent, long residence-time environment.

Case Study

In the Philippines a joint partnership has operated between local government, Holcim Limited (a Swiss company that is one of the world's leading suppliers of cement), and Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (the German Agency for Technical Cooperation, an international enterprise for sustainable development). The partnership explored opportunities to use waste products, rather than fossil fuels and primary raw materials, in cement manufacture.

Research

In November 2004 a trial was carried out in the Bulacan cement plant of the Union Cement Corporation. The Bulacan cement plant is equipped with a semi-automatic facility for co-processing solid, liquid and sludge wastes as alternative fuels.

The trials have shown that co-processing leaves no residue or waste, and does not reduce cement quality. Measurements of PCDD/PCDF emissions reveal clearly that co-processing of waste produces no significant hazards. Such emissions have been consistently below 0.1 ng-TEQ/Sm^3, which is the limit value under the European Community legislation for hazardous waste incineration plants (Council Directive 2000/76/EC).

Outcomes

Co-processing of waste in cement kilns offers advantages for the cement industry as well as for waste management authorities (Figure 10). Cement producers can save on fossil fuel and raw material consumption, contributing to a more eco-efficient production. Another advantage is that this waste-recovery method uses an existing facility, eliminating the need to invest in new purpose-built incinerators or secure landfill sites.

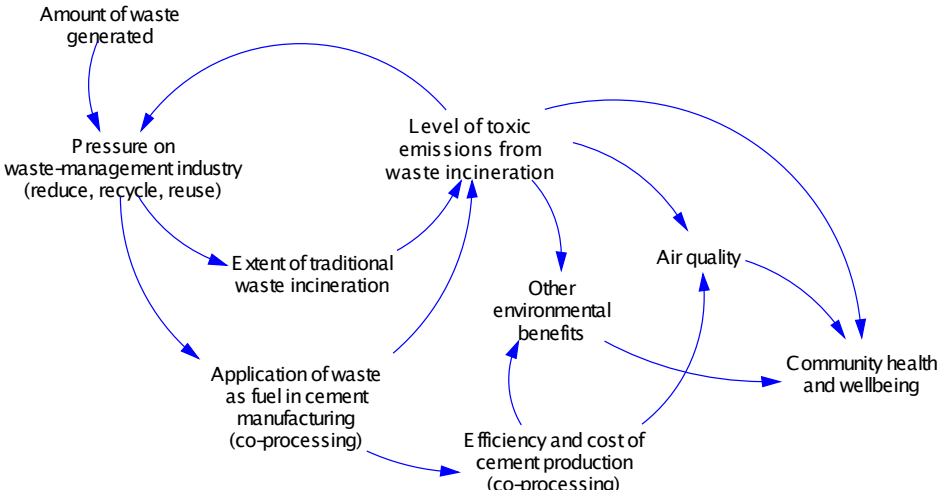


Figure 10. *Systems influence diagram of the relationships between waste incineration and community health and wellbeing. Policies on building waste management facilities are influenced by cost, efficiency and safety.*

06
Implementation

Overall Approach

Much needs to be done to provide the science on which informed policy decisions can be made for the improved health and wellbeing for the people in the cities of the Asia-Pacific region. The increasing rate of extreme climate events and natural disasters in the Asia and Pacific highlights the importance of urban sustainability as a contributor to wellbeing.

Our approach is based on the understanding that health and wellbeing in the urban environment is influenced by many factors, and that these factors interact with and influence each other. For this reason we emphasise that a systems approach should be adopted to capture these links. A systems approach ensures that a broad view is taken, interactions between social, cultural, environmental and economic factors are recognised and the optimum places to intervene are identified. Research based on a systems approach helps to identify the intended and unintended consequences of policy applications.

In putting together these recommendations, we are following the structure laid out in section 6 'The Science Programme' of the ICSU Report[4] , and we have concentrated on actions to be taken by the ICSU Regional Office for Asia and the Pacific for the implementation of a science programme on health and wellbeing in the changing urban environment.

There is a growing understanding in the region that urban health and wellbeing depends not only on medical care but on multiple factors. Moreover, the ability to use the systems approach is varied across the region. Therefore we are proposing that the first two steps in the implementation of our Science Plan should be:

1. capacity building, with particular attention being paid to the utility of the systems approach to this complex problem;

2. the development of an exemplar research project centred on one or two cities in the region to serve as an example of how the systems approach can deliver better outcomes.

We also need to build and facilitate knowledge networks, which allow research and best practices in one city to be disseminated to other cities. In this way cities and communities can rapidly learn from one another.

We then propose to use the research as a base for developing outreach programmes with the target groups including the policy makers and the administrators on the one hand and the residents on the other hand.

Our final recommendations are directed towards ensuring the integration of the ICSU regional and global science plans.

[4] *Health and Wellbeing in a Changing Urban Environment: a Systems Analysis Approach*. An interdisciplinary science plan. The report of an ICSU Planning Group to ICSU, 2010.

Capacity Building

The interdisciplinary and integrated systems approach to health and wellbeing is still in its infancy. There are various options for strengthening the knowledge base and building capacities. This may vary from having specialised institutions, networking existing ones with local, regional and international centres, to merely holding periodic workshops, and seminars.

The different groups with an interest in, and the capacity to influence, urban health and wellbeing include health professionals, urban planners, policymakers, scientists, civil society and urban developers. Capacity building is required for all of these groups, but we defer a discussion of capacity building for civil society until later, as it is usually classified under outreach. For the others:

1. Policy makers need awareness of the multidimensional issues involved, of the necessity to consult many scientists and institutions, and of the utility of the systems approach in improving health and wellbeing;
2. Health professionals need to recognize that achieving the goal of health and wellbeing requires more than disease control and medical treatment;

3. City planners need to appreciate that a goal of their planning should be the health and wellbeing of the people, and that achieving that requires understanding the links between urban planning, and physical and mental health;

4. Authorities need the data to make informed decisions and to assess the outcomes of those decisions. Building the capacity to identify, collect, verify and analyse these data is an important component in improving health and wellbeing;

5. Scientists need to appreciate that by working together in interdisciplinary teams, and adopting a systems approach, they would have a greater impact on health and wellbeing; and

6. Developers need to be convinced that a positive impact on health and wellbeing could be an important selling point , to the city authorities and to the public.

Communications, Outreach and Public Awareness

Civil society is of course the ultimate stakeholder or beneficiary of any work undertaken to enhance health and wellbeing in the changing urban environment. It has many roles to play in developing and implementing actions.

To do that, it needs to :

- identify societal problems that can be fed to the analysis cycle;
- understand and support the policy changes that ensue;
- work towards the implementation of the new policies.

Public education must be undertaken at many levels and the younger the people who are educated, the greater the transformational impact. Children who learn the importance of environmental impact on health could carry the message for a lifetime and also influence parents and other adults.

An example of the importance of finding the correct target audience is the experience of India where celebrations during Diwali, the festival of lights and worship of the goddess of wealth, include noisy fire crackers, leading to air pollution and potential for fire accidents. It has a high emotive quotient and warnings by the government were not heeded by the public. However a sustainable impact was seen when school children were sensitised and they then promoted safety measures.

It must not be forgotten that the informal settlements and urban slums which are considered the bane of cities, are populated by resourceful people having voting power and ability to contribute to the wealth of the city. Dharavi, the largest slum in Asia is in Mumbai and is the centre for many of the products that drive the economy of the rich city. Nairobi slums have organized communal kitchens and community vegetable gardens in open spaces using waste bins and plastic bags.

This shows the importance of communications, outreach and public awareness in any program on health and wellbeing, and the difficulty of designing and delivering an appropriate program. A major difficulty is the diversity of the different target groups, and thus the need for tailored communication programs. We will need to get our message out beyond the internet if it is to have the desired impact on civil society at large.

Perhaps the most effective way to do this is to enlist the support of the leadership groups who have been convinced of the value of the program.

Leaders and Governance — A Special Case of Outreach

Governance at national, regional or local levels is always dependent on the art of balancing interacting and often conflicting drivers to produce the desired outcome, and to avoid undesirable, unintended consequences. The scientific way to study such interacting influences is to use a systems approach, and its use can inform the art of good governance.

The systems approach to decision making in general, and to reach the goal of improving health and wellbeing in urban environments in particular, needs to be better understood by the leaders and policy makers in urban areas. The scientific community advocating this approach has a special responsibility to convince the policy makers to heed the results from such studies, and to support studies of relevance to them.

We see the exemplar city study as providing a base for outreach to policy makers, although its successful implementation depends on already having convinced the leaders of that city of its usefulness.

Research Into Action

There are at least three different types of densely populated urban areas, old established cities, say over 100 years old, new planned cities and new urban centres which have developed spontaneously, including informal settlements.

Some urban areas are amalgamations of two or three of these. Improving health and wellbeing in the city has many common aspects, but much would depend on just which type of city (or which part of the city) is the research target. Reorganising or retrofitting established cities is a challenging task, perhaps more so than designing a new one, keeping the health and wellbeing of the inhabitants in mind. Townships of more than 1 million tend to get disorganised, leading to crowding and health-related issues.

We are proposing that a systems approach be used to unify the understanding of all of the relevant factors. Furthermore, we are recommending that it be adopted in the study of one or two cities, thus providing a model and a training ground.

Given in Box 3 are components required to initiate a research programme.

Box 3 Components of Systems Approach to an Urban Health Research Project.

Team	Modelling experts, economists, health economists, behavioural scientists, city planners, sanitation experts.
Process	Collaboration between 1) public health personnel 2) finance managers 3) civil society, NGOs, households.
Method	Modelling to include determinants such as migration, behaviour, sanitation, household parameters, disease prevention such as vaccination, access to nutrition, education, job opportunities and other disciplines such as engineering.
Variables	Incorporate data on demographic, economic, job markets, health access for women, children aged.
Feasibility	Depends on what data is available, what needs to be developed. Existing data may prove to be weak in some countries. Nevertheless a beginning has to be made if only to analyse what data needs to be developed. Validation of data is a prerequisite for developing a good model. Some countries do not permit access to some health data.
End Users	Policy relevance/impact is paramount. To ensure early acceptance close interaction with bodies/institutions trusted by the policy makers should form part of the team.
Outcomes	Information that would help in understanding the interrelationships of the drivers and causes in planning health and well being in the changing urban environment.

The first steps are to decide on the target city and on the research project, which should be sufficiently focused to be achievable, yet broad enough to demonstrate the advantages of a systems approach. It may be efficient for this exemplar study to be based on one of the cities featured in our case studies, as they are already models in a sense. Then one has to determine the primary focus of the study. Again this could be developed from the case studies. Next one has to assemble the research team, and decide on its organisation. Depending of the focus of the study, this could include medical and social scientists, statisticians, economists, health economists, behavioural scientists, city planners, transport engineers, architects, sanitation experts and modelling experts.

This team will need obtain the information about the city that is essential to the study. The necessary data may already exist, but some of it may need to be collected. The data set could include data on:

- prevalence of disease; preventive measures by public health authorities: access to medical care;
- nutritional quality; potable water availability; sanitation; air and household pollution data;
- population statistics; population distribution through the parts of the city; patterns of socio-economic inequalities in small areas in the city; migration of people into and within the city; patterns of crime;
- private vehicle usage; public transport; cycling and walking patterns;
- access between residences and workplaces, schools, and hospitals; availability of recreational and green spaces
- access to education; access to employment;
- risk of natural and human induced hazards and disasters.

Then the research team should construct qualitative or quantitative systems models to determine the interaction between the intervention and the parameters which have been measured, and the resulting influence on the health and wellbeing of the population.

It is important to build interactions with the city government and other key stakeholders at the start of the project and to continue them throughout it. This helps to ensure that those questions which are being asked in the research are those which policy makers consider relevant to their decisions.

Involving Civil Society — Communications, Outreach and Public Awareness

Civil society is of course the ultimate stakeholder or beneficiary of any work undertaken to enhance health and wellbeing in the changing urban environment. It has many roles to play in developing and implementing actions to do that:

- it needs to identify societal problems that can be fed to the analysis cycle;
- it needs to understand and support the policy changes that ensue; and
- it needs to work towards the implementation of the new policies.

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Perhaps the most effective way to do this is to enlist the support of the leadership groups who have been convinced of the value of the program.

Interacting with the Global ICSU Health and Wellbeing Programme

This Regional Office for Asia and the Pacific Science Plan is being developed at the same time as ICSU itself is developing its interdisciplinary science plan for *Health and Wellbeing in a Changing Urban Environment: a Systems Analysis Approach*[4]. The ROAP Plan is an adaptation of the global plan to the needs of the Asia Pacific Region, and is a step towards the implementation of that Plan. It is therefore important that strong links be maintained between the regional plan and the global plan.

The rapid growth of urbanisation in our region would make it sensible for the IPO of the global plan to be located here, and we recommend that National Members be encouraged to bid for it. But wherever the IPO is located, the ICSU and its ROAP must ensure close cooperation between the IPO and the region.

07

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Appendix 1

Terms of Reference Science Planning Group on Health and Wellbeing in the Changing Urban Environment.

Goal: To provide a science plan that the ICSU Regional Office for Asia and the Pacific can use to enhance fundamental science, promote research on the science and application of urban health and wellbeing in Asia and the Pacific.

The Terms of Reference for the Science Planning Group on Urban Health and Wellbeing are as follows:

1. To review and analyse the current status of research, training and development needs including case histories in urban health and wellbeing in Asia and the Pacific.

2. To assess the interests of the ICSU Scientific Unions, Interdisciplinary Bodies and Joint Initiatives in the science of urban health and wellbeing.

3. Consider how the ICSU Plan might be implemented at the regional level and identify synergies with other ICSU ROAP priority areas/activities

4. To suggest major areas of research and development to achieve the goals of enhancing the role of the science of urban health and wellbeing in sustainable development of societies in Asia and the Pacific.

5. To examine capacity building and training needs that would enable broad dissemination and application of the results of research on the science of urban health and wellbeing in Asia and the Pacific.

6. To identify ways by which the results of the research in the priority themes can be made meaningful and more available to decision- and policy-makers and other development stakeholders in the region.

7. Identify ways by which the research in this theme can be made meaningful and more available to decision- and policy-makers, and other stakeholders in the region

Appendix 2

Members of ICSU ROAP Science Planning Group on Health and Wellbeing in the Changing Urban Environment.

Indira NATH (Chair)
Raja Ramanna Fellow
Institute of Pathology (ICMR)
Safdarjung Hospital Campus
New Delhi 110029
India
Tel: +91 11 26100754
Fax: + 91 11 26100754
Email: indiranath@gmail.com

Anthony CAPON
National Centre for Epidemiology and Population Health
Building 62
Cnr of Eggleston and Mills Roads
The Australian National University
Acton Australia
Tel: +61 418416569 (MOBILE)
Fax: + 61 261250740
Email: tony.capon@anu.edu.au

Philippa HOWDEN-CHAPMAN
Deputy Head
Department of Public Health
University of Otago
Wellington South
New Zealand
Tel: +64272201620
Fax: +6443885314
Email: philippa.howden-chapman@otago.ac.nz

Reiko KISHI
Hokkaido University Centre for Environmental and Health Sciences
Mid-Campus Open Laboratory Building,
No 1, Kita 12, Nishi 7, Kita-ku
Sapporo, Japan, 060-0812
Tel: +81-(0)11-706-4746
Fax: +81-(0)11-706-7805
Email: rkishi@med.hokudai.ac.jp

Jaime MONTOYA
Executive Director
National Research Council of Philippines
36, Rebueno St. Philamlife Village,
Pamplona, Las Pinas City,
Philippines
Tel: (+ 632) 8372942
Fax: (+ 632) 8372942
Email: mnty_jm@yahoo.com

Barry NEWEL
Visiting Fellow,
Fenner School of Environment and Society
Adj. Assoc. Professor, School of Engineering and Computer Science
The Australian National University,
Canberra, ACT, Australia
Tel: +61 2 6125 4882
Mobile 0488 572 309
Email: barry.newell@anu.edu.au

Katrina PROUST
Research Fellow
National Centre for Epidemiology and Population Health
College of Medicine, Biology and Environment
The Australian National University
Building 62, Mills Road
Canberra ACT 0200 Australia
Tel: 02 6125 6836
Email: Katrina.Proust@anu.edu.au

Yong-Guan ZHU
Director General
Institute of Urban Environment
Chinese Academy of Sciences
1799 Jimei Road
Xiamen, China
Tel: +86 592 6190997/008613806072815 (HP)
Fax: +86 592 6190977
Email: ygzhu@iue.ac.cn

Ex-officio
Mohd Nordin HASAN
Director,
ICSU Regional Office for Asia and Pacific
c/o Academy Sciences of Malaysia
902-4, Jalan Tun Ismail,
50480 Kuala Lumpur
Tel: + 603 26984192
Fax: +603 26917961
Email: nordin.hasan@icsu-asia-pacific.org

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Notes

ICSU Regional Office for Asia & Pacific,
902-4, Jalan Tun Ismail,
50480 Kuala Lumpur, Malaysia
Tel. +603 2698 4192 • Fax +603 2691 7961
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