

# Megacities and urban health<sup>1</sup>

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*December 2009*



**2009**

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<sup>1</sup> Part of this document is derived from the following two presentations:

1) Armada, F: Megacities: Challenges for global health. 12th World Congress on Public Health World Federation of Public Health Associations (WFPHA). Istanbul, Turkey, 28 April 2009

2) Armada, F: What can urban health learn from studying megacities? 8th International Conference on Urban Health, ICUH 2009, Nairobi, Kenya, 18–23 October 2009

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Printed in Japan.

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## SUMMARY

Megacities are cities of 10 million or more inhabitants. There are more than 20 megacities in the world and they are highly diverse. They concentrate national and global economic and political power as well as scientific, political and media attention. When analysing health in megacities, it is difficult to separate the effect of size from other variables. However, cities of similar size do not necessarily suffer from the same problems, and at the same time common issues can be found among cities of very different dimensions. Nevertheless, starting with an analysis of their common characteristics, we identify nine challenges that megacities face which have particular health impact: transportation, governance, water and sanitation, safety, food security, water and sanitation, health care, emergency preparedness, and environmental issues. Each challenge is analysed in terms of its relationship with urban health. They are highly influenced by the complexity of megacities in terms of population size, geographical extension, social inequalities, and usually multiple and fragmented metropolitan governments. We conclude that given the variation among megacities and the extent of commonalities between megacities and other lower population settings, the relevance of the megacity as a category in urban health is limited. Yet the identification of these challenges, and the different ways in which they are being handled, is useful for shedding light on determinants of health and potential intersectoral interventions in a range of urban settings well beyond this group of cities.

## 1. INTRODUCTION

As of 2007 there are 19 megacities in the world (Table 1) and they are highly diverse, spanning from New York, USA to Karachi, Pakistan. According to a UN definition that focuses on population size, megacities constitute a special group of cities of 10 million or more inhabitants. In 1950, only two cities had a population over that threshold (New York-Newark, USA; and Tokyo, Japan). Mexico City joined the group 25 years later; by 2025 it is projected that 27 cities will be in that category, most of them in the “developing world”. Megacities currently cover about 4% of the total world population, and some 9% of urban population (UN 2007). Some researchers and organizations adopt different definitions of megacities, that can include many other cities (see an example below from Bohle and Warner 2008).

Megacities tend to concentrate national and global, economic and political power as well as scientific, political and media attention. Many are national capitals, such as Mexico City, Tokyo, Manila and Paris. Most are the principle national hub of economic activity, and many have great regional or global influence. Daily coverage in the international media of the financial markets in New York and Tokyo is an illustration of that.

In addition to academia, megacities have attracted a lot of attention in popular culture. They have frequently been settings or themes in popular film and literature where the worldwide tendency to urbanization is portrayed and fantasized (e.g. Tezuka’s *Metropolis*, 1949). This is an indication of the interest of the public, as is the mass media coverage of the topic (see for example: Linden 1993).

Many disciplines have approached the study of megacities including geography, urban planning, management, social and political sciences, and environmental science (e.g. Prud’homme 1996, Kraas 2007, Decker et al., 2002; Kolossov and O’Loughlin 2004; and Ser 1998). Certain industries have also studied the phenomenon, including the energy sector and in particular the insurance sector in terms of risks and commercial opportunities (see for instance: Münchener Rückversicherungs-Gesellschaft 2004). In addition, there are several academic societies and NGOs that follow the topic including the International Geographic Union, with a taskforce devoted exclusively to the study of megacities (University of Cologne 2009); and the Mega-Cities Project that claims to group “leaders from government, business, non-profits, grassroots groups, academia and media, dedicated to sharing innovative solutions” to the most common problems of those urban centres (Megacities Project 2009).

The United Nations has also addressed the issue of megacities. In addition to providing a widely-accepted definition (2007), it prepared several reports on population growth and public policies in specific mega-cities through its Department of International Economic and Social Affairs, Population Division in the late 1980s. A collaborative project between WHO and UNEP led to the publication of an analysis about air pollution in megacities (1992). In a recent collaborative project, the United Nations University sponsored a scientific report on megacities, mostly addressing the issue of resilience and social vulnerability with examples from India, Bangladesh, and Colombia (Bohle and Warner 2008).

In contrast, the field of urban health, judging by the available scientific publications, has paid limited attention to megacities as a specific area of study or intervention: most papers address conditions particular to one megacity, while others attempt to compare their conditions or policies. The objective of this review is to explore some of the relevant issues for urban health that can be derived from the study of megacities; as well as the relevance of such a classification for urban health as a discipline.

## 2. SOME KEY ISSUES FOR URBAN HEALTH IN MEGACITIES

For the analysis of urban health and its determinants in megacities, it is difficult to separate the effect of size from other variables. Moreover, cities of similar size might have very different problems, while cities of very different size might share common concerns. The relevancy of crime is one example of that situation. Commonly high on the political agenda of megacities is the issue of safety and security. However, the incidence of violence varies widely from one city to another (as with many of the other characteristics). Violent crime, given its impact on quality of life and health statistics, is one of the most important public health concerns in many cities, including megacities such as Lagos and Sao Paulo. See for instance the analysis of spatial segregation by income, of which "gated communities" are an example (e.g. Coy and Pöhler 2002). Meanwhile, it does not seem such an important quality of life issue for the Asian cities.

Nevertheless, starting with an analysis of their common characteristics, relevance for public health, and reports of main public policies concerns among policy-makers in several megacities (GlobeScan and MRC McLean Hazel 2007), it is feasible to identify a group of key issues that megacities face which have particular impact on the process of addressing their inhabitants' health. For instance: transportation, governance, water and sanitation, safety, food security, health care, emergency preparedness, and environmental issues. Each challenge represents a potential lesson for urban health as a discipline. Looking at the different ways in which these issues are being handled sheds light on the determinants of health and potential intersectoral interventions in a range of urban settings well beyond this group of cities.

Among these key megacity issues that strongly influence public health, we focus on four areas: transportation policy, governance, nutrition, and assessment of inequalities. They are a source of examples of the effect of social determinants of health, and also of the need for intersectoral action to increase urban quality of life.

### 3. TRANSPORTATION POLICY

One of the key public policy concerns in megacities is transportation. Given the high population density, high motorization rates, and long commuting distances, the need to improve transport is a common issue among policy-makers and their constituencies, and multiple policy options and challenges are always present. Although the relationship between transportation policies and health is not widely acknowledged, it is very strong and spreads over many health issues (Dora 1999). The extent to which public transport is used in lieu of private transport and the type of vehicles used directly impacts air quality, a key issue for health in megacities (Molina and Molina 2004). The physical activity levels of people living in cities is also impacted by transport options, with regard to the quality of sidewalks, pedestrian and cycle safety, security and other interrelated factors. Traffic accidents are also clearly related to transport policies.

Most of the megacities have mass-transit systems and are in the process of strengthening them. For instance, among the developing country cities, Lagos officially opened the first phase of a Bus Rapid Transit System based on exclusive lanes for buses in March 2008 (Mobereola 2009). Evaluations of the impact on health are very limited at this early stage, although quality of life improvement seems clear due to this system.

A key transport policy that positively affects public health is the promotion of non-motorized transportation options such as walking and cycling. Such policies work to encourage physical activity, improve air quality, and could also reduce traffic accidents.

For instance, research in Tokyo showing that the availability of parks and other green spaces positively influenced the longevity of urban senior citizens was used as the basis to propose the creation of easy-to-walk green areas in urban planning for the development and redevelopment of densely populated areas in megacities (Takano et al. 2002).

Infrastructure and regulations must be in place to make non-motorized transport safe. Studies in cities and countries with successful interventions in this area provide examples of interventions (e.g. Pucher and Dijkstra 2003). Bicycle-sharing programmes are an increasingly widespread measure to promote non-motorized transport. Unfortunately this approach remains largely restricted to midsize European and Asian cities, although Paris is approaching megacity status (DeMaio and Gifford 2004, Noland and Ishaque 2006, Mairie de Paris, 2009). Of course, there are many other ways to promote cycling as a means of transport, such as interventions implemented in New York City that have increased cycle lanes and bicycle parking options. The city claims an increase in the use of bikes for commuting of 35% from 2007 to 2008 (New York City 2009).



## 4. GOVERNANCE

Urban governance is as complex as the cities themselves. This is even more the case in megacities, given the size of populations and their geographic spread. A common characteristic of megacities is the co-existence of multiple administrative bodies of government, often with overlapping and even contradictory mandates in terms of both thematic and territorial competencies.

The government of some megacities are territorially divided into several non-related jurisdictions, while most others are integrated into a single metropolitan authority. In some cases, there is both a metropolitan authority and several smaller governments that take care of sections of the cities. Specialized agencies usually cover major concerns such as transport, environment and health, but often they are also the focus of more than one governmental agency. These characteristics are particularly relevant for cross-sectoral action, since the interrelated web of health determinants that acts in urban settings demands interventions beyond a single sector of the government; and a supportive governance structure is a key factor the success of such an approach.

Megacities are often national capitals (nine out of 19 of the 2007 list). Being a capital can increase complexity in terms of the presence of a large public sector, special legislation to adjust to this condition, tensions between national and local legislation and increased share of national economic activity. It often constitutes both a challenge and an opportunity, depending on the relationship between the national and local government.

Urban planning is a crucial instrument for city governance. It contributes to shape how a city is organized (e.g. access to services, land tenure and use, availability of green spaces), and therefore has a substantial effect on health and health equity. Cities often develop a master plan to map the future directions of their growth or renovation. Such plans constitute an opportunity for public health to intervene on many different social determinants (e.g. housing, access to education, and water and sanitation).

The sheer physical size of megacities has often called for a polycentric approaches rather than a monocentric planning approach and structure. Brennan and Richardson (1989) illustrate with a successful example from Asia, but warn about the common lack of follow-up through of such plans. Multiple centres of political power and services facilitate people's access to a wide range of services, and also has the potential to facilitate citizens' involvement in the process of policy-making.

A megacity consumes an enormous amount of resources and produces a huge array of products as well as waste, including toxic materials. Only a small fraction of a city's needs can come from within its borders, just as most of the waste finds its way out of the city. Therefore a huge area is required outside the city limits to feed a megacity and handle its waste. As such, megacities have a strong influence on a large population outside their boundaries, economically, socially and environmentally. This "exchange" of resources also marks the relationship between city authorities and the national or other local governments.

Beyond institutional organizations and local contexts, governance in urban settings also depends on the prevailing political tradition, as at the national level (Navarro et al., 2006). Therefore, the way in which the country is organized, the distribution of authority between local and national governments, and the essential character of their public policies (redistributive or not) are a strong influence on the governance of each megacity.

## 5. ASSESSMENT OF INEQUALITIES

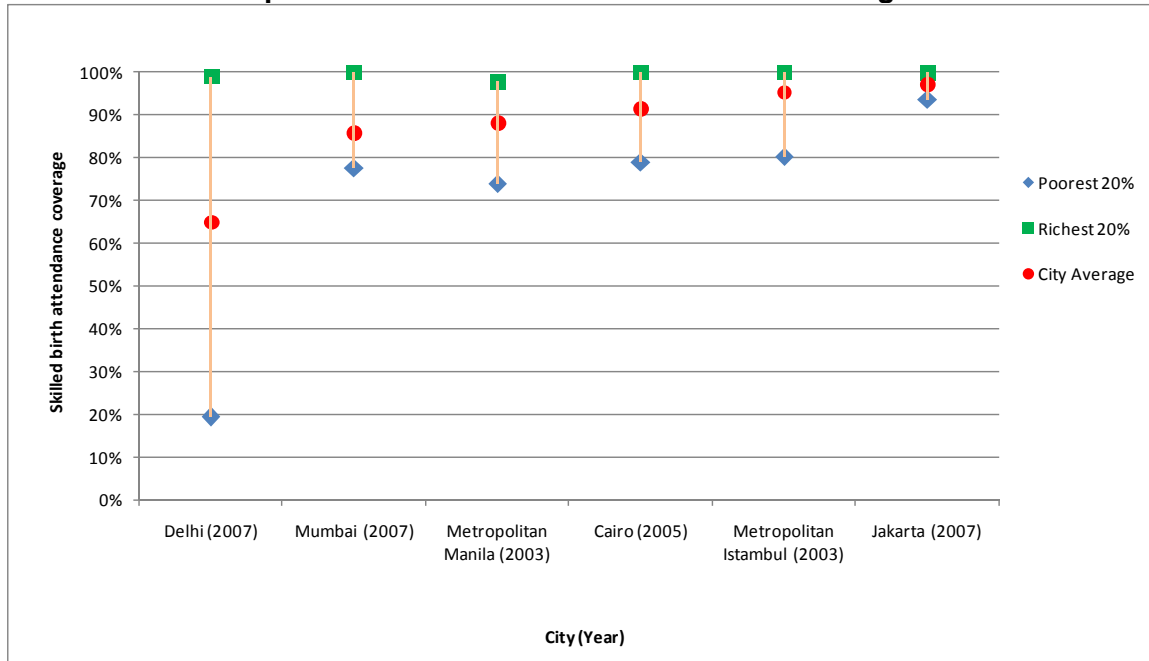
Availability of information, population size, and concentration of wealth set the scene for abundant and detailed analysis of the health disparities found in the megacities. Many published analyses identify a wide range of health inequalities within the megacities. A comparison of income inequality and infant mortality by zip code area within New York City not only found great internal variations for both indicators, but also showed a significant association between them (Sohler et al., 2002). In Sao Paulo, Brazil inequalities in access to health care services and their utilization were pointed out within that city (Pessoto et al 2007). A health observatory in London pointed out several of the health inequalities within that city, as well as the importance of intervening on their social determinants (London Health Commission, 2007).

However, while other megacities may not be the subject of such analysis of internal inequalities; they may have studies that focus on severe deficiencies, or on particular diseases or conditions. Those approaches also illustrate the presence of huge inequalities. Those type of studies are present in most of the megacities in developing countries, covering a variety of issues including poor indoor air quality (Kulshreshtha et al 2008) and vulnerability to HIV/AIDS due to precarious socioeconomic conditions (Ghosh et al., 2009) in the slum areas of Delhi; HIV-related risk behaviours among rickshaw pullers in a slum of Dhaka, Bangladesh and Hepatitis A inequalities among children of different socioeconomic status areas in Cairo (Salama et al. 2007).

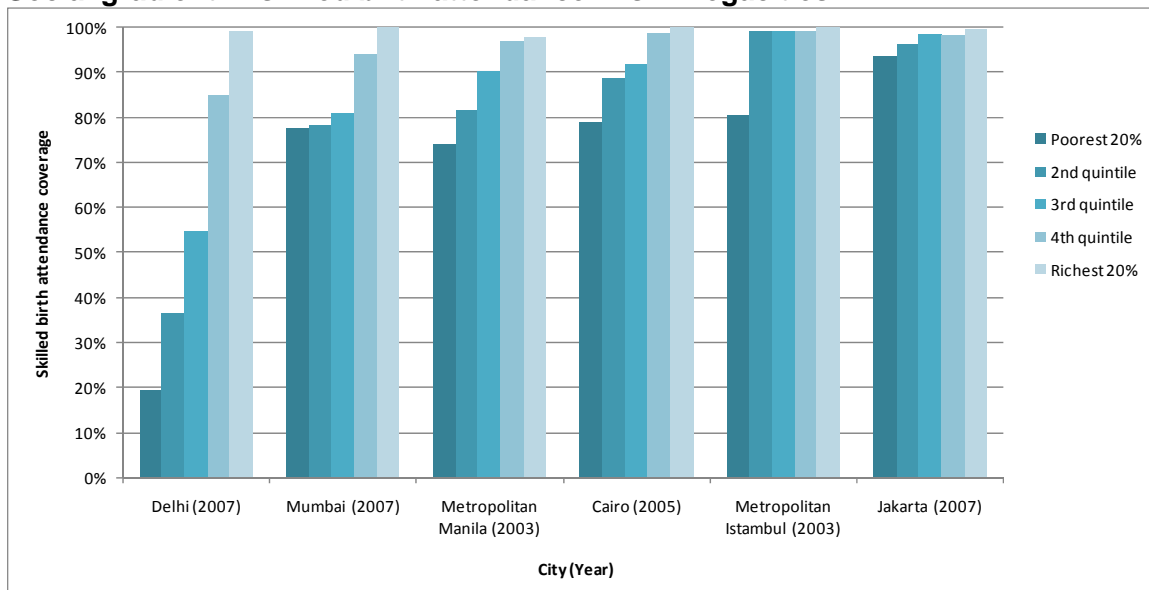
Neither of these two groups of assessment are exclusive to megacities. Many other cities have looked at their internal health inequalities and studies on highly deprived areas are common among cities with populations of less than 10 million. Overall within-city health inequalities have been described for example in Barcelona, Spain (Barceló et al. 2009); for infant mortality in Santiago, Chile (Donoso 2004); and for death rates from unintentional injury among Canadian children in urban areas (Birken et al. 2006). Studies on health and living conditions in slums are also abundant beyond the megacities, for instance: Vaid et al., (2007) described the situation of infant mortality in a slum in a small Indian city; the quality of water among several Kenyan slum dwellers has also been studied (Kimani-Murage and Ngindu 2007); geohelminth infection among slum-dwelling children in Durban, South Africa (Appleton et al., 2009); and numerous studies on living conditions in North American inner cities (e.g. Eggleston 2007).

An analysis of available information for maternal and child health from the DHS allows us to identify disparities by socio-economic characteristics for a group of megacities from which the information was available (Delhi, Mumbai, Manila, Cairo, Istanbul and Jakarta). For skilled birth attendance by income group, all of them showed a significant gap between the richest and the poorest 20%. For most cities, the coverage of skilled birth attendance is close to 100% for the richest 20% of the population, while the coverage of the poorest fifth of the population varies from 20% in Delhi to close to 90% in Jakarta (Figure 1). In analyses that look at all five income quintiles (Figure 2), most of the cities present a gradient in access among them. The specific patterns vary widely between cities, yet the overall correlation of low income to poor health outcomes remains. This pattern is seen for stunting within Istanbul, Cairo, Delhi and Mumbai (Figure 3). However, such disparities are not exclusive to megacities. As shown in Figure 4, a mix of megacities and other cities for which information was available for the comparison of skilled birth attendance, similar variations are shown.

In conclusion, income inequalities and highly correlated health outcomes are not exclusive of megacities. Megacities do not seem to follow more than a very basic common pattern of internal inequalities, and they do not have common characteristics that make assessment of intra-city inequalities easier than in smaller cities.

**Figure 1****Income-based inequalities in skilled birth attendance in six megacities**

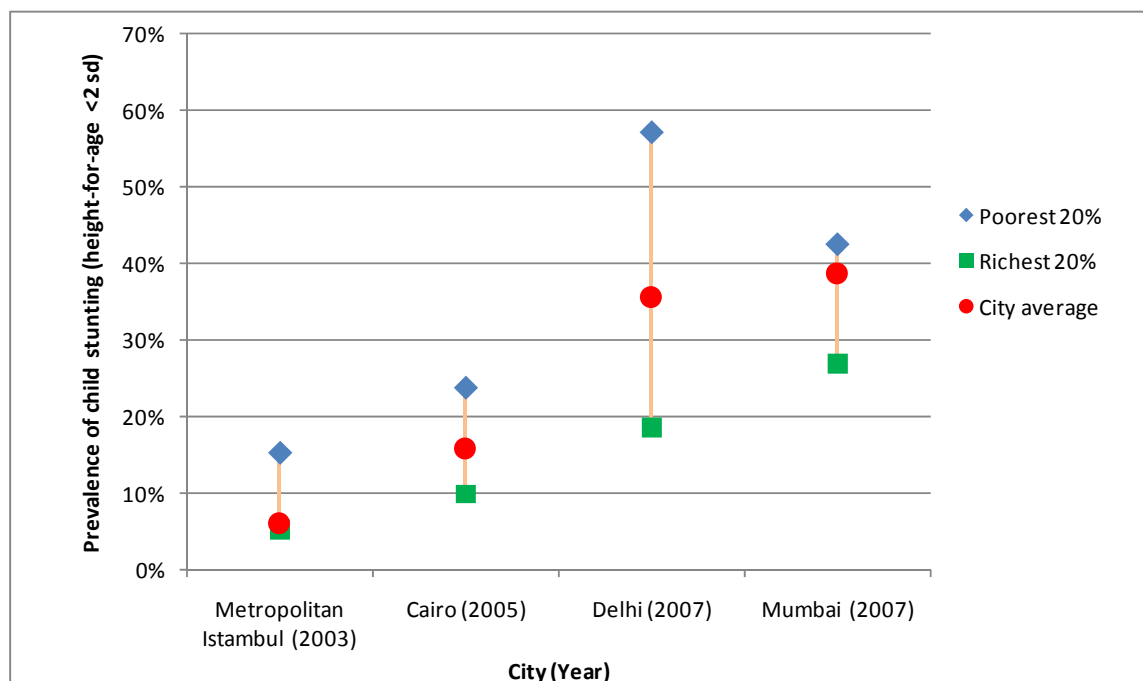
Source: Demographic and Health Survey data from 2003–2007, analysed by M. Kano (WKC, 2009)

**Figure 2****Social gradient in skilled birth attendance in six megacities**

Source: Demographic and Health Survey data, analysed by M. Kano (WKC, 2009)

**Figure 3**

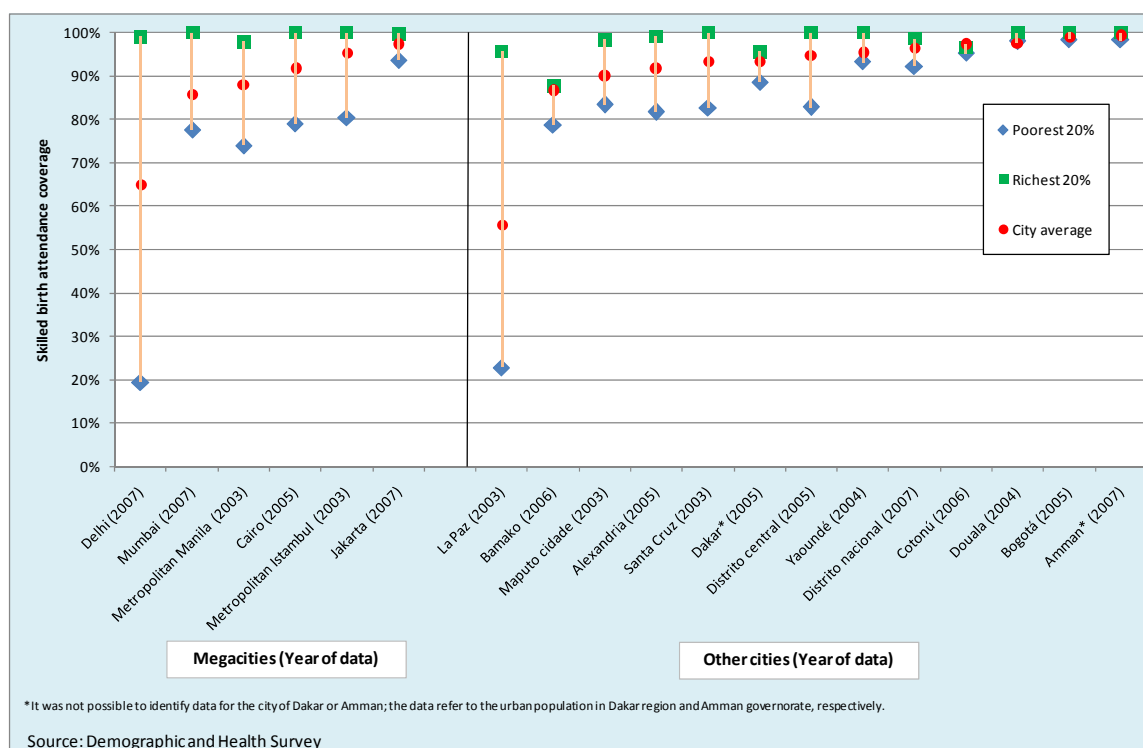
**Inter- and intra-city income-based inequalities in stunting within four megacities: Istanbul, Cairo, Delhi and Mumbai**



Source: Demographic and Health Survey data, analysed by M. Kano (WKC, 2009)

**Figure 4**

**Maternal and child health: Skilled birth attendance coverage**



Source: Demographic and Health Survey

Source: Demographic and Health Survey data, analysed by M. Kano (WKC, 2009)

## 6. FOOD SECURITY

Population density, sprawl and complex distribution networks make food availability an important challenge for megacities. Although it has several aspects, food distribution is a common issues in cities, and the recent rise in the price of food has brought a new urgency. As with other issues in the megacities, lack of access to sound nutrition is a problem affecting the population in unequal ways. Several experiences shed light on the numerous options for increasing food availability, including governmental interventions to regulate and facilitate the distribution and marketing of staples; and urban agriculture. In this case too, similar challenges are present in cities of different sizes.

What may differentiate megacities is first, the huge demand for staples that needs to be satisfied, requiring enormous energy and with great impact on surrounding areas and other places where the food comes from. Second, megacities might be more likely to have stronger regulatory bodies than can influence the way the food is marketed, therefore on its quality.

Regarding food availability, many cities have explored options for increasing food production within their geographical boundaries. Many have promoted food-growing in community gardens, backyards, urban and peri-urban farms, vacant lots, schools and other public land. The results have gone beyond food production to include benefits such as nutrition education and increased opportunities for physical activity (Dixon et al 2009). A study carried out in Lagos reported on some of the challenges of such activities in terms of access to land and credit (Ezedinma and Chukuezi 1999). The experiences in Jakarta, Cairo, Shanghai, Dhaka, and Mexico City also show the feasibility of this intervention in the presence of appropriate public policies (Cai and Zhang 1999 ; Lima et al. 1999; Mbaye and Moustier 1999, Purnomohadi 1999; and Gertel and Samir 1999).

Although not officially a megacity, a study of urban agriculture in London helps to illustrate both the footprint that megacities have on their surrounding areas and the rest of the world; and the quest for options to increase food availability. Petts (2001) reported that London would require the equivalent of 125 times its surface area (i.e. the size of the entire productive land area of Britain) to sustain the demands for food of its inhabitants. Existing urban agriculture is limited and faces many challenges: it is chemical-intensive, lacks developed markets in the city, and strong competition for land use. Nevertheless, it demonstrates an alternative for generating fresh food and preserving highly appreciated green spaces in London.

Another group of governmental interventions focus on increasing access to sound nutrition by dealing with existing barriers such as food price (e.g. Cassady 2007). In fact, a WHO review (2009) reported that “sales of healthier options generally increased in interventions where these options were available and/or were reduced in price”. Regardless of the difficulty of generating evidence for successful policies in this area (see for instance Glanz and Yaroch 2004), several strategies and principles have been identified as promising for interventions. One of them is the acknowledgement that environmental and policy interventions are more likely to shift dietary patterns than actions targeted at individuals (Seymour et al., 2004). Furthermore, a review of interventions documented from 1970 to October 2003 provides support to strategies that focus on the “point of purchase” and on increasing the availability of nutritious food (Matson-Koffman et al., 2005). Unfortunately, there are not many examples from megacities. One exception is the New York City’s Green Carts Program that aims to increase availability of fresh fruit and vegetables by increasing the points of purchase (New York City Department of Health and Mental Hygiene, 2009).

Another clear example of the potential for regulation is New York's initiative to restrict the use of artificial trans fat in restaurants on the basis that its consumption increases the risk for coronary heart diseases. Initially a voluntary approach was taken, but the results were not fully satisfactory. In December 2006, a regulation established that artificial trans fat would have to be phased out in the preparation of food in restaurants. Evaluation of this measure points toward a major reduction in trans fat use, and that similar regulations have been adopted by other governments in the USA (Angell et al 2009; Tan 2009). The regulatory approach can be effective. Of course, it is not an exclusive option of megacities.

There are many other examples of regulations that address both food availability and utilization and have been classified among the effective interventions identified by WHO (WHO 2009). Several of those are directed toward the protection of children from the negative impact of food marketing. Hawkes in a 2004 WHO report cites a number of examples, including some megacities: a) the cities of Rio de Janeiro, Florianópolis, and São Paulo (Brazil) banned the sale and distribution of soft drinks and confectionery anywhere within school boundaries; b) Hong Kong has statutory guidelines on food advertising to children on TV; c) some American cities (including Nashville and Seattle) have banned an in-school news channel that broadcasts advertising; d) bans and guidelines on foods and drinks permitted for sale in vending machines were introduced in some American school districts including Los Angeles and New York City.

## 7. CONCLUSIONS

We conclude that given the variation among megacities and the commonalities they have with other lower population settings, the relevance of the megacity as a category in urban health is limited. Cities of 10 million or more people do share many problems related to their size, but evidence is lacking for conclusions that can be drawn from this size threshold in itself. Moreover, factors like geography and climate are important determinants that vary from one city to other. Likewise, political factors are fundamental and also change over time. There are alternative ways to classify megacities, for example, the typology of cities based on growth rate as proposed by Duh et al (2008) to explain the relationship between urbanization and the resilience of air and water quality.

So we have seen that megacities can have more in common with smaller cities than with those of their size. Additionally, the use of several different definitions of megacities in urban research makes it difficult to categorize those cities in the same group. For instance, Brennan and Richardson used in 1989 “a population of at least 8 million projected by 2000” and selected 10 cities in Asia, several of which have not yet reached the status of megacity according to the UN threshold.

Nevertheless, the identification of these challenges and the different ways in which they are being handled is useful for understanding the determinants of urban health and potential intersectoral interventions in a range of urban settings well beyond this unique group of cities.

City-to-city comparisons are helpful, and megacities are fertile ground for these. For instance, Ohkado et al (2005) prepared several recommendations to strengthen TB control in Osaka and London after comparing their strategies. Another example of this type of analysis is the World Cities Project (Rodwin and Gusmano 2002), designed to compare health systems between three of the richest megacities in the world, as well as one megacity-to-be, Paris. The authors argue for comparing world cities over nation-states. Rodwin et Neuberg (2005) compared New York, Tokyo, Paris, and London in terms of the strength of the association between income and infant mortality rate within their respective neighbourhoods.

We should continue studying megacities and, in general, the implications of city population for health and health equity, but the bewildering array of megacities is a real challenge for an overarching analysis. Megacities certainly provide a great opportunity for diffusion of social policy to other urban areas because they are strongly connected to many other cities through a complex spatial division of labour (see for instance Borges 2008) and because their high visibility facilitates such processes.



**Table 1**  
**Megacities 2007 and 2025 (projected)**

<b>2007</b>			<b>2025</b>		
Rank	Urban agglomeration	Population	Rank	Urban agglomeration	Population
1	Tokyo, Japan	35.7	1	Tokyo, Japan	36.4
2	New York-Newark, USA	19.0	2	Mumbai (Bombay), India	26.4
3	Ciudad de México (Mexico City), Mexico	19.0	3	Delhi, India	22.5
4	Mumbai (Bombay), India	19.0	4	Dhaka, Bangladesh	22.0
5	São Paulo, Brazil	18.8	5	São Paulo, Brazil	21.4
6	Delhi, India	15.9	6	Ciudad de México (Mexico City), Mexico	21.0
7	Shanghai, China	15.0	7	New York-Newark, USA	20.6
8	Kolkata (Calcutta), India	14.8	8	Kolkata (Calcutta), India	20.6
9	Dhaka, Bangladesh	13.5	9	Shanghai, China	19.4
10	Buenos Aires, Argentina	12.8	10	Karachi, Pakistan	19.1
11	Los Angeles-Long Beach-Santa Ana, USA	12.5	11	Kinshasa, Democratic Republic of the Congo	16.8
12	Karachi, Pakistan	12.1	12	Lagos, Nigeria	15.8
13	Al-Qahirah (Cairo), Egypt	11.9	13	Al-Qahirah (Cairo), Egypt	15.6
14	Rio de Janeiro, Brazil	11.7	14	Manila, Philippines	14.8
15	Osaka-Kobe, Japan	11.3	15	Beijing, China	14.5
16	Beijing, China	11.1	16	Buenos Aires, Argentina	13.8
17	Manila, Philippines	11.1	17	Los Angeles-Long Beach-Santa Ana, USA	13.7
18	Moskva (Moscow), Russian Federation	10.5	18	Rio de Janeiro, Brazil	13.4
19	Istanbul, Turkey	10.1	19	Jakarta, Indonesia	12.4
			20	Istanbul, Turkey	12.1
			21	Guangzhou, Guangdong, China	11.8
			22	Osaka-Kobe, Japan	11.4
			23	Moskva (Moscow), Russian Federation	10.5
			24	Lahore, Pakistan	10.5
			25	Shenzhen, China	10.2
			26	Chennai (Madras), India	10.1
			27	Paris, France	10.0

Source: United Nations, Table I.6. Population Of Urban Agglomerations with 10 million inhabitants or more, 2007 and 2025



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