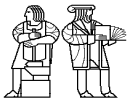

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A PROPOSAL TO IMPROVE THE HEALTH CARE SYSTEMS FOR THE URBAN POOR IN THE SQUATTER SETTLEMENTS OF THE DEVELOPING COUNTRIES

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A Proposal to Improve the Health Care Systems for the Urban Poor in the Squatter Settlements of the Developing Countries

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Introduction

The world population is rapidly becoming urban. The major concern with the rapid urbanization of the world population is the fact that over the next 30 years virtually all population growth will take place in urban areas of the developing countries. For most of the developing countries, which have unstable economies and inadequate infrastructure, a rapid urbanization process is overwhelming because it refers to much more than simple population growth. The most challenging features of rapid urban growth are the economic, environmental and social changes it introduces in the urban environment and urban life.

The rapid and unplanned growth of cities strains the capacities of service providers. Governments are not able to meet the soaring demand for energy, education, health care, transportation, sanitation and physical security. Inadequate provision of services and the inability to maintain the basic upkeep of cities due to insufficient revenues and limited budgets result in "urban sprawl", serious environmental problems, and widespread poverty. In many cities in the developing world, urban sprawl exists in the form of city dwellers living in the urban periphery in poverty and environmental degradation with lack of urban services, including running water, trash pickup, electricity or paved roads. These living conditions tremendously increase the burden of health for the urban poor.

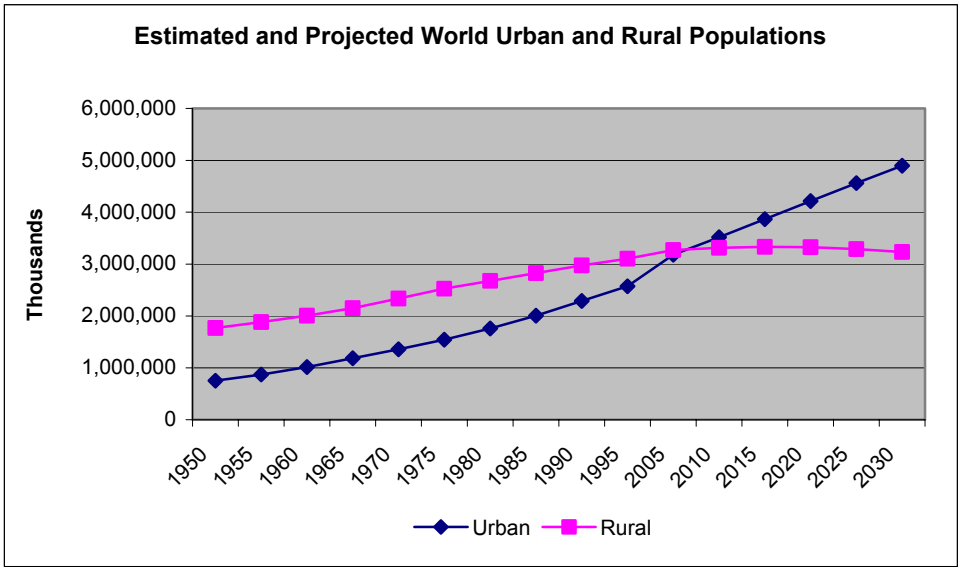
Rapid urbanization and large scale population movements from rural to urban areas have resulted in unprecedented health crises in the developing countries. In addition to communicable diseases, respiratory infections and malnutrition, psycho-social stresses due to marginalization and exclusion from social activities and employment prospects are also prevalent. Considering the rate of urban growth rate and the rapid increase in the percentage of the poor living in urban areas, the debilitating effects of health crises and urban poverty are going to exacerbate if no precautions are taken. In this respect, it is a critical point in time to come up with effective health care strategies for the urban poor. This document provides an insight into the reasons behind the current health problems of the urban poor and the determinants of health in developing countries, and proposes use of operations research to come up with handling strategies for the major subdivisions of the health problem in the developing world.

Background

The importance of promoting the health, physical and social living conditions for the urban poor in the developing countries stems from the fact that the urban population in the developing world accounts for the majority of the world population and its percentage is increasing at a very rapid rate. In this respect, how these countries will meet the challenges of rapid urban growth will determine the future of these people and hence, the future of the world. With increasing globalization, the notion of "local regional problems" is loosing its validity. The problems tend to become global as the long-term effects affect the rest of the world, much faster compared to the past. One example of the latest

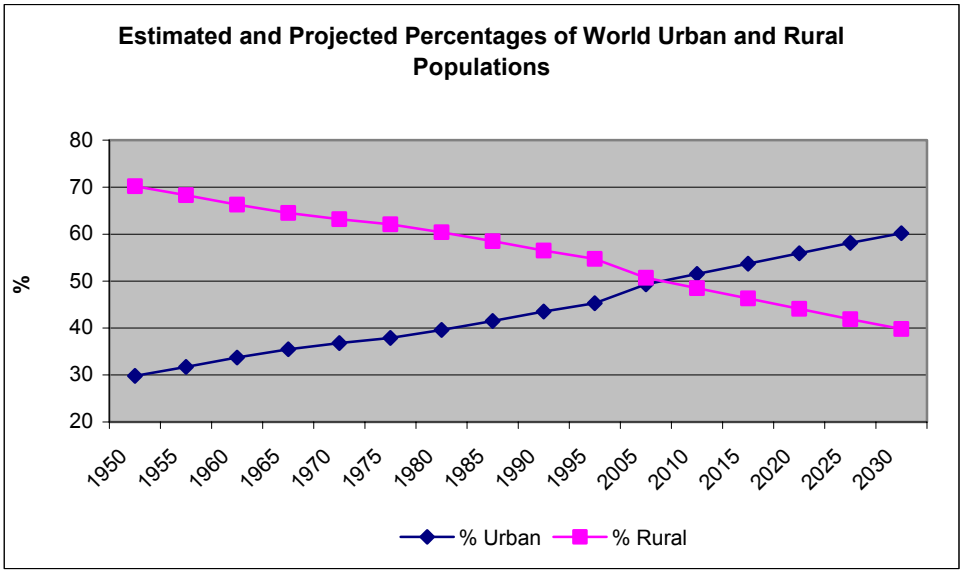
epidemics which is a global threat is the outbreak of the Severe Acute Respiratory Syndrome (SARS) in China. The dramatic increase in world population accompanied by the advances in technology and transportation is creating denser world economic, social and environmental interactions. Globalization is characterized by three dimensions: *interactions, homogenization and spillovers*. *Interactions* refer to the multiplication and intensification of economic, political, social and cultural linkages among people, organizations and countries at the world level, including for example larger trade and increased levels of tourism. *Homogenization* refers to the tendency toward universal application of economic, institutional, legal, political and cultural practices. The increase in the number and coverage of environmental treaties and cultural homogenization in entertainment, food and health habits are some of the examples for non-economic aspects of homogenization. *Spillovers* refer to the consequences that the behavior of individuals and societies *have* on the rest of the world. Examples include cross-border pollution, global warming, the global spread of SARS, HIV/AIDS and other diseases. Globalization can affect health outcomes through several channels, such as trans-national movement of health risks, socioeconomic factors that affect the distribution of the global burden of diseases and the effects of expanded trade in health commodities and services [7].

Although throughout most of history a rural lifestyle was dominant among the human population, currently the trend is shifting towards "urbanization", even in developing countries that used to be predominantly urban till the last few decades. In 1975, only 27% of people in the developing world lived in urban areas. In 2000 the proportion was 40%, and projections suggest that by 2030 the developing world will be 56% urban, which corresponds to an increase from the current 2 billion to 4 billion in the next 30 years (Figure 1.a). Although the developed world is already far more urban, at an estimated 75% in 2000, the major threat of urban growth of developing countries is the fact that they are growing much faster, and their populations are much larger (Figure 2). In total, urban areas are gaining an estimated 67 million people per year—about 1.3 million every week. By 2030, about 5 billion people are expected to live in urban areas—60% of the projected global population of 8.3 billion (Figure 1.b).



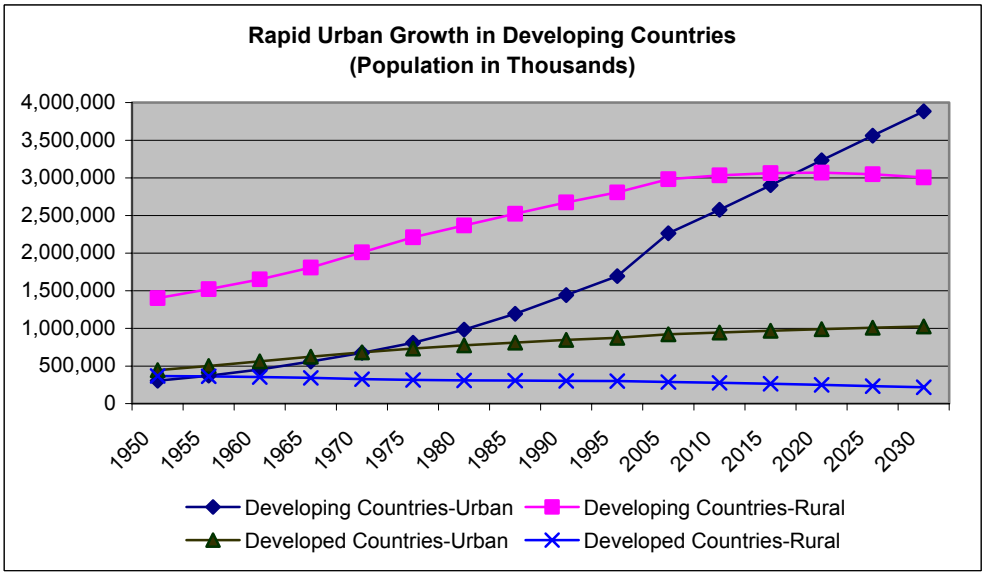
Source: United Nations, 2002 (http://esa.un.org/unpp/)

Figure 1.a. World Urban and Rural populations (thousands), 1950 – 2030



Source: United Nations, 2002 (http://esa.un.org/unpp/)

Figure 1.b. Percentages of World Urban and Rural Populations, 1950 – 2030



Source: United Nations, 2002

Figure 2. Estimated and Projected Urban and Rural Populations of Developing and Developed Countries, 1950 - 2030

The reasons for urban growth and characteristics of this growth are not identical in each country; however, overall in developing countries rapid urban population growth reflects three basic factors:

- Migration from rural areas and from other urban areas,
- Natural population increase (births minus deaths) among urban residents,
- Reclassification of previously rural areas as urban as they become built up and change character.

Migration is often explained in terms of either "push factors" – conditions in the place of origin which are perceived by migrants as detrimental to their well-being or economic security, and "pull factors" – the circumstances in new places that attract individuals to move there. Factors that pull residents to some urban areas include access to better jobs, education, health care, and higher living standards (pull factors). In general, cities are perceived as places where one could have a better life because of better opportunities, higher salaries, better services, and better lifestyles. Factors that push people out of the countryside include adverse rural conditions, the deteriorating quantity and quality of agricultural lands, poor market infrastructures, and lack of supporting institutions, such as sources of credit for small-scale farmers.

Problems associated with rapid urban growth can be summarized as follows:

- *Inadequate Housing and Services:*

Around the world over 1 billion urban residents live in inadequate housing, mostly in slums and squatter settlements, where living conditions are poor and services are insufficient. One-quarter of all urban housing units in developing countries are temporary structures, and more than one-third do not conform to building regulations. Squatter housing is often made up of materials such as plastic sheets, cardboard or scrap-metal, which are easily destroyed by floods and storms. Urban slums include both high-density dwellings, such as high-rise apartments, and squatter settlements and shanty-towns, where people occupy vacant land and illegally build shacks for themselves. Many illegal settlements are built on land poorly suited for housing—for instance, on floodplains or on steep hillsides—and are especially prone to damage from natural disasters. Landfills and garbage dump sites may also be occupied for scavenging. Such areas carry high risks of accidents and health problems, especially for the children, from contact with toxic and fecal wastes. For example, in Cairo families living on trash heaps contract hepatitis through contaminated medical waste [9].

Slum residents usually lack security of tenure—that is, the right of legal access to and use of the land and buildings they occupy. Each year several million urban dwellers experience forced eviction. An estimated 20 million to 40 million urban families are homeless, some because they have been evicted and some because they cannot afford any housing, even illegally. It is particularly difficult for the urban poor to obtain tenure because property registration processes are inefficient, complicated, and expensive. The process is even more difficult in the case of informal settlements. Many governments hesitate to legalize them for fear of encouraging even more illegal settlement. The threat of eviction, relocation, or demolition is stressful and traumatic. Stress-related illnesses, such as high blood pressure, may be produced due to fear and uncertainty.

People in slums often must pay more for services than other urban residents, and they receive services of lower quality. The scarcity of public water supplies forces many low-income urban residents to use other water sources, often private water vendors who charge many times the public rate. In Istanbul, Turkey, water from private vendors costs 10 times the public rate, while in Mumbai (formerly Bombay), India, vendors charge 20 times more. Poor households often spend 5% to 10% of their incomes to buy water.

- *Urban Sprawl:*

One of the major effects of rapid urban growth is "urban sprawl"- scattered development that increases traffic, saps local resources and destroys open space. Urban

sprawl is responsible for changes in the physical environment, and in the spatial organization of cities. Developed and less developed countries of the world differ not only in the percent living in cities, but also in the way in which urbanization is occurring. In Mexico City (950 square miles), as in many other mega cities in the developing world, urban sprawl exists as nearly 40% of city dwellers live in the urban periphery in poverty and environmental degradation. These high density settlements are often highly polluted owing to the lack of urban services, including running water, trash pickup, electricity or paved roads. Overcrowding when combined with malnourishment creates favorable conditions for the spread of communicable diseases, especially for increased spread of tuberculosis.

- *Urban Poverty:*

Growing urban poverty is a major concern. About 30% of the poor now live in urban areas. By 2035 the proportion is projected to reach 50%. In 1988 the World Bank estimated conservatively that some 330 million urban poor in the developing world were living on less than US$1 a day. In 2000 the estimate had increased to 495 million. In over half of developing countries with data on poverty, as defined by the countries themselves, at least one urban resident in every five lives below the national poverty line. Most of the urban poor live in slums and squatter settlements, without adequate access to clean water, sanitation, and health care. While health and child survival rates are better in urban than rural areas on average, they often are worse for the poor than for other urban residents. Many municipalities cannot keep up with the soaring demand for water. Where access to clean water is scarce, sanitation is poor, contributing to a variety of water-related diseases.

Urban poverty may be even more debilitating than rural poverty because in urban areas, unlike rural areas, access to virtually all goods and services depends on having a cash income. Furthermore, services that governments usually provide free in rural areas, such as schooling, usually carry costs for households in urban areas—for example, school fees and expenditures for school uniforms, books, and transportation. Urban residents have to buy most of their food, while rural residents grow a substantial portion of their own food, and food prices often are higher in urban areas than in the countryside. Urban households spend 60% to 80% of their income on food. Poverty has risen as fewer people can find steady jobs with adequate wages.

- *Health Burdens and Health Crises:*

On average, the health of urban residents in developing countries is better than that of rural dwellers, in part because urban areas usually offer better health care and healthier living conditions than most rural areas. Infant and child mortality rates are lower in urban areas than in the countryside. The average child born in an urban area has a much better chance of survival than does a rural child. In 54 of 57 countries with data from the Demographic and Health Surveys (DHS), infant mortality rates—deaths before age one per 1,000 live births—were lower in urban than in rural areas. Similarly, child mortality rates—deaths to children ages one to five per 1,000 children surviving to age one—were lower in urban than in rural areas in 56 of the 57 surveyed countries.

Within urban areas, however, the urban poor face many more health risks than the average urban resident. The urban poor are more vulnerable to poor health and environmental hazards because they are more likely than others to lack adequate housing, sanitation, and other basic services. In large cities of developing countries, child mortality is highest among children whose mothers recently migrated from rural areas and those

who live in low-quality housing. The extent of childhood illnesses is closely related to poverty levels and to the quality and extent of health care, clean water supply, and sanitation.

Basic services needed for good health often do not reach the urban poor because municipal authorities do not recognize many informal settlements for political and administrative reasons, and thus these areas are not eligible for services. In some cases, slum areas are not classified as urban precisely because they lack services. Also, as mentioned above, the urban poor often settle on land not suitable for housing. Extending infrastructure such as roads, water mains, and sewer lines can be difficult because of rough terrain. In order to lay water or sewer pipes, the utility authorities often must remove or relocate many houses. Lack of adequate water supply and the absence of facilities for the disposal of excreta are the key indicators of poverty, which also are the main contributors to child morbidity and mortality, especially from diarrheal disease. The following two tables summarize the findings of research comparing the health status of people living in poor versus non-poor areas of the same city.

Table 1.a. Urban Health in Poor and Non-poor Areas of the Same City

Infant Mortality Rates (per 1,000)		
City	**Poor**	**Non-poor**
Porto Alegre, Brazil	43	18
Karachi, Pakistan	152	32
Aggregate Urban, Guatemala	113	33
Manila, Philippines	210	76
Sao Paulo, Brazil	175	42
Delhi, India	180	18

Source: Diana Silimperi, based on Report of the Panel on Urbanization, 1992 and World Development Report, 1993.

Table 1.b. Urban Health in Poor and Non-poor Areas of the Same City

Infectious Disease Morbidity and Mortality Differentials		
City	**Disease**	**Difference in Poor vs. Non-poor**
Manila, Phillipines	Tuberculosis Diarrhea Typhoid	9x 2x 4x
Porto Allegre, Brazil	Pneumonia/influenza mortality Septicemia mortality	6x 8x
Sao Paulo, Brazil	Enteritis, diarrhea, pneumonia mortality in infants	2x

Source: Diana Silimperi, based on Report of the Panel on Urbanization, 1992 [8].

About 20% to 50% of all solid waste goes uncollected in cities of the developing world. In informal settlements virtually no waste collection exists. The fact that these settlements are constructed without clear roads, on steep hillsides, or locations that make truck access impossible causes the mountains of garbage to become the playground for children, work sites for scavengers, and health hazards for the squatters [9].

The major effects of poor environmental conditions are the high rates of diarrheal diseases (including cholera), acute respiratory infections (ARI) and vector-borne diseases. Diarrheal dehydration kills over 2 million children under the age of five in one year alone.

Urban epidemics have erupted as a number of traditionally rural parasitic diseases emerged in cities in developing countries in the past decades, due to rural migration and the proliferation of breeding sites. Respiratory diseases have a higher chance of being prevalent in urban areas rather than rural areas because crowding promotes the transmission of infectious organisms. According to a study published in World Health Statistics (I. Romieu, "Urban Air Pollution in Latin America and the Caribbean," Vol. 23, No. 2, 1990), over 2 million city children in Latin America suffer from chronic coughs. In developing countries that have made the transition to industrialization, it is not only the diseases and hazards associated with development that threaten the residents of urban slums but the more typical diseases of developed countries, such as cancer, stroke, heart disease, and chronic lung disease also have started to emerge[8].

In addition, governments and donor agencies give low priority to providing such services as primary health care, basic education, family planning, water and sanitation, and nutrition, according to an analysis of 17 developing countries around the world. The UN and the World Bank agree that, on average, 20% of national budgets in developing countries and 20% of international aid should be allocated to extending these basic services to all people -both urban and rural. In the 17 countries studied, however, the average expenditure on these services was only 12% of total government spending -from 8% in Lebanon to 17% in Nepal. In urban areas the poor usually suffer most from a lack of basic services but are the last to be included in urban planning and infrastructure improvements. Their disadvantage mainly reflects their lack of political power and influence [1].

Government health spending tends to favor the rich, mostly because a disproportionate share goes to curative care and hospitals, which are more frequently used by the rich, rather than to services the poor rely on, such as clinics. A comparison of the public spending on health devoted to different income quintiles in 12 countries from different regions illustrates this inequity. In a majority of the countries, the richest 40 per cent receive a larger share of the total outlays than the poorest 40 per cent. In only four countries -all of them in South America- do the poorest and richest 40 per cent receive a comparable share of public resources [6]. In most developing countries, national health budgets are allocated mostly to hospitals. A small percentage of resources is used to establish municipal networks of community-based health centers and primary health care centers. The small number of clinics and hospitals that serve the poor are often overcrowded, understaffed and poorly equipped.

To approach the advancing health crisis in developing countries, it is essential to focus on community and family-level preventive activities to eliminate the causes of illness, in particular the child health risk factors that are presented in the Table 2. Over the long term activities such as the provision of safe water supplies, construction of excreta sanitation facilities, collection and proper disposal of solid wastes, promotion of hand washing and safe food handling are cost-effective [8].

Table 2. Child Health Risk Factors in the Urban Slums

Risk Factor	Diseases			Death
	ARI	Diarrhea	Malaria	
Poor water quality		x		
Poor sanitation		x		
Insufficient garbage collection/disposal		x		
Poor drainage/free-standing water			x	
Crowding	x			
Air pollution (indoor and outdoor)	x			
Poor/under nutrition	x	x		x
Poverty	x	x	x	x
Low maternal education				x
Lack of nearby primary health care facilities				x

Source: Diana Silimperi

Along with the environmental factors, the urban social environment also affects the health of its residents. Socioeconomic factors, such as marginalization, illiteracy, class or caste status and gender, often determine whether a group lives in poverty or not. Urban dwellers that belong to poorer groups live in poor-quality housing neighborhoods devoid of municipal services, which creates unhealthy environments and high risks for young children [9].

Another dimension of the problem is the fact that when poor people go to health care facilities, they feel scorned and despised relative to people of higher wealth, which results in impression of humiliation and uselessness. These effects are sometimes combined with low quality service and bad treatment by the medical staff, and results in unwillingness to go to a health care center [10].

A critical point for urban health is the point that a large proportion of morbidity and mortality in the developing world is the result of preventable diseases, which are poverty related and which can be prevented by relatively simple interventions such as vaccination. Infectious diseases like gastro-enteritis and measles, the major causes of death in infants, are both preventable. The main determinants of gastro-enteritis are poor sanitation and inadequate water supplies. The coverage of measles vaccination should be increased to prevent measles epidemics in overcrowded peri-urban areas. Urban populations also begin to experience more of the diseases of affluence that are predominantly chronic as urbanization proceeds. Changes in diet and the acquisition of habits such as smoking and drinking alcohol have introduced increases in heart disease and lung cancer cases. The changes in lifestyle can also affect the mental health of new arrivals. When people lose contacts with their established support networks, cases of mental disorders, alcohol, other substance abuse and violence may increase [10].

Problem Statement

Health systems in many countries do not have the capacity or the commitment necessary to deliver essential services to those most in need. Excessive centralization of health planning, large central bureaucracies, weak management, the absence of community participation, insufficient qualified human resources, inadequate funding for health by countries and donors with different priorities and strategies, vertical

programming (i.e. planning and implementing programs such as immunization, diarrhea control, health education separately), inadequate attention paid to country needs, and lack of recognition of the impacts on health of national policies and development projects in other sectors have all contributed to failures in the health sector. Ultimately, this results in unsustainable programs. However, the rapid increase in the number of the urban poor necessitates the development of health care strategies to have a sustainable social and economical environment. Therefore, the major determinants of health in the urban poor areas of the developing countries should be identified and accordingly measures should be taken in order to maximize the prospects for a healthy and stable future.

Health is largely a matter of the social, physical, economic, political, and cultural environment of the communities in which people live and grow. The major determinants of health in a developing country illustrate the need for a broad societal view of health and illness. Major determinants of health in developing countries are as follows [2]:

- low status of women / gender inequity
- illiteracy and limited education, particularly of girls and women
- poverty and inequity
- rapid population growth and rural-urban migration
- poor nutrition / lack of food security
- squatter settlements and poor housing
- inadequate access to safe water and sanitation
- environmental degradation
- socio-political instability, conflicts, and migration
- inadequate access to health services

The importance of health status of poor people stems from the fact that the ability of the poor to survive and to be wealthy in developing countries' societies is often dependent on their labor force, i.e. their physical force. A degraded health status makes an ill man less able to work. As a consequence, the ability to receive income is lost, which further causes degradation in health since lack of income is a major obstacle in getting proper health care and having a sound nutrition. In this sense, health is a major concern for the developing countries as health status has impacts on economic development, education, and social stability. Improving health status can prevent poverty by building human and social capital and increasing productivity [10].

Objectives

The overall objective is to improve the health care services to the urban poor so as to provide them with adequate health care and decrease the inequality in health care provision between the poor and the rich. The fundamental factors for improving health are ensuring access to preventive and curative health services and empowering individuals and families to take responsibility for their own health through health promotion and health education. Through a timely use of preventive health care, it is possible to save in direct medical costs in the long term. Prevention is currently one of the main points of attention to maintain equity, efficiency, and quality. In parallel to the basic determinants of health in developing countries, the following sub-objectives can be considered [2]:

- Improving women's health and reproductive health
- Improving children's health

- Decreasing malnutrition and eliminating micronutrient deficiencies
- Preventing and controlling pandemics for which cost-effective interventions exist
- Improving clean water supplies and sanitation

As a group, urban poor women sustain unusually high risks for increased morbidity and mortality due to childbearing and the adverse effects of their responsibilities as food gatherers and providers, caretakers of children and the ill, and the maintainers of the home shelter [8]. In India, a national institute of Urban Affairs study on the composition of the adult urban poor suggests that 65% are women. Over 70% of India's population below the poverty line is composed of women and children. Majority of the urban population is made up by children below the age of 15, which has important implications for public policy decisions and health care strategies. Illiteracy is also another predictor of poverty and thus health. In Egypt, incidence of poverty among households that are headed by illiterates is 48% in urban areas [9].

Children, being the most vulnerable, should be the most important target group for the health sector. Therefore, services for child care are of utmost importance. 75% of the 12 million deaths among children who are under five years are due to curable diseases, such as pneumonia, diarrhea, measles, malaria or malnutrition. Immunization and promotion of breastfeeding are the most important steps to be taken to improve child health. Women may defer treatment of their own illness in order to get care for their own children and families. Social norms may also affect women's mobility and hamper their access to care. In Yemen, for example, women do not go to health services alone unless they are nearby and they must first seek approval from their husbands or a male member of the community [10].

The essential cost-effective clinical services that should be delivered to individuals include family planning, prenatal, childbirth and postpartum services; care of acute childhood and malnutrition exacerbated illness, including diarrhea, respiratory infection, measles and malaria; tuberculosis control; sexually transmitted disease control; care of injuries and care of common infections. The most highly cost-effective package of public health services that can be delivered through community-wide programs include immunizations; school-based health services; family planning services and education; nutrition services and education; tobacco, alcohol and AIDS prevention; and environmental protection, including sanitation, food safety, water purification, safe housing and air pollution control. According to the estimates of the World Bank, this minimum package of clinical and public services could reduce the disease burden by 32% in low income countries (equivalent to US$350 per capita income) at an estimated annual budget of US$12 per person (or 3% of per capita income) [5].

"Health reform and capacity development" is one of the most important strategies to improve health and attain specific health goals. According to UNAIDS, prolonging life and reducing morbidity are not the only purpose of health care systems, and of health care reform; and producing health care procedures or interventions is not its only output. Since people -not health care systems- produce health, the capacity of people to maintain their health on their own should be an equally important purpose of the health care system [6]. With health promotion, people should be enabled to increase control over their health and to improve it. Health education is a common strategy for health promotion since it is an effective means of changing knowledge, attitudes and to some degree health behaviors. Some important elements of a health reform strategy are:

- political commitment and inter-sectoral action;
- situation analysis, health information systems and health planning at local, district and national levels (bottom-up participatory planning);
- human resources planning and training of health professionals;
- effective decentralization to districts and communities, with close collaboration with non-governmental organization (NGOs) and other development partners;
- local governance and community participation;
- empowerment of households and of women in particular;
- development of the capacity of health systems and services to implement health promotion and prevention activities and to foster the development of healthy public policies;
- evaluative research on programs and services, research training, and essential national health research.

In short, the main aim is to promote the development of a sustainable national health system. A well-functioning health system should ensure universal access to quality essential public health and clinical services through an integrated primary health care approach, engage in health education and health promotion, promote the development of healthy public policy in other sectors, and provide well-targeted, effective and committed programming to meet the objectives set by the national health plan. National health systems do not imply that governments should provide all health services. Rather, governments should ensure equity and universal access to essential services, provide funding, and determine the roles of players within the sector to ensure an optimal health outcome at a sustainable cost for the country.

Approach

Major issues in providing health care to the urban poor in the developing countries involve the effective location of health care facilities, allocation of the available budget between preventive and curative health care services, determining the prevalent disease types and the priority levels of these diseases with respect to urgency for treatment - which can be carried out by market segmentation of the urban poor population, management of the health care providers and determination of the specialization levels of the medical work force, and introducing effective queuing strategies to minimize the weighting times of the patients, thus satisfying the demand of a higher number of people within a given time period and making a more efficient utilization of the health care personnel. In this respect, Operations Research provides some techniques and methods, such as location-allocation optimization models and queuing theory that can be used to handle the above mentioned issues. The major subdivisions of developing an effective health care system for the urban poor are:

- *Provision of Preventive Health Care vs. Curative Health Care:*

To have a sustainable health system a combination of preventive and curative health care services are needed. However, the emphasis should be on preventive care rather than curative care. Curative care places a much heavier burden on response resources. In sudden onset of natural disasters such as earthquakes where there can be a significant need for trauma care, curative care may takeprecedence over preventive care.

In some developing countries like in India, hospital based disease and cure oriented approaches have been set as the cornerstone of health investment, to the neglect of preventive, promotional and rehabilitative aspects of health care and health policy has been dominated by Western curative hospital-based system of medicine, which brings about some negative outcomes for the urban poor due to centralization. A major part of investment in public health has gone in building curative health infrastructure and medical personnel, and on supplying curative drugs. On the other hand, China has attained a dramatic impact on the health profile on the Chinese people with its stress on preventive health between 50s and 80s. To give an example, the average life expectancy of Chinese people has increased from 35 years 1949 to 69 years in 1985 and infant mortality fell from 250 to 35 per 1000 between 1949 and 1989 [3].

Low-income countries are spending only $21 per capita per year for all forms of health care, much of it directed to expensive curative services to the detriment of basic health prevention and care [6]. Given the low expenditures on public health in developing countries, the high proportion of it spent on curative aspects of health reflects inadequate understanding of health policy and lack of a clear political will to reach out to the poor. Greater stress on prevention and promotion of public health can have a far more significant impact on public health indices. In achieving public health goals, it can be far more cost effective to focus on prevention to a much greater extent, particularly "primary prevention" which removes the possibility that the disease will occur by taking action prior to the onset of the disease. For example, a range of diseases resulting from malnutrition can be prevented by nutritional interventions for vulnerable groups. Environmental modifications for safe drinking water, toilets, drainage and decent housing prevent many major diseases. Immunization and health education, as for iodized salt, washing hands, safe delivery, reduced alcohol and nicotine intake can again prevent many prevalent diseases among the urban poor.

In addition, several of the vital interventions for promoting health and preventing disease are non-clinical in character, and can be effectively implemented by non-professionals and para-professionals like health workers. According to estimations, 80-90 percent of the health problems of the urban poor can be resolved without clinical intervention. This fact might relax the over-dependence on medical professionals, especially doctors in most public health strategies [3].

In short, preventive health care should be emphasized in the provision of health care services to the urban poor. However, the decomposition of the budget between preventive and curative measures depends on the individual country conditions and varies with respect to the effectiveness of the existing health facilities, and the health parameters of the urban poor.

- *Market Segmentation of the Urban Poor Areas with Respect to Their Demand for Health Care:*

In urban medical services, calls that involve criticalness and danger to human life should be given higher priority over health care calls for more routine and non-urgent incidents. Prioritizing is needed because the servers, i.e. the health personnel, are limited in number and every call cannot be answered simultaneously. So, a natural response to the limited number of health care providers is to create a prioritization scheme for the health care calls. Market segmentation of the urban poor with respect to their frequency of

demand to specific diseases enables the identification of the different levels of priorities. In general, according to the dependence of the patients on time for receiving treatment, it is possible to segment the population into different categories such as *critical cases,* where urgent treatment is vital for survival; *serious cases,* where early treatment is important but not as vital in critical cases; and *stable cases,* where treatment can be delayed without any serious medical consequences.

As stated above, priority setting is important for developing countries because of the limited resources and health care capacity. Prioritization might be characterized with respect to the health services, population affected or health problems. In this respect, factors that play an important role are the distribution of certain diseases with respect to age, gender and geography; morbidity/mortality rates among certain populations; magnitude of a disease-in terms of the number of people involved, its impact or seriousness and its vulnerability to management -which can be measured in terms of cost of intervention and whether the problem is preventable and amenable to remediation. In general, the following decision making hierarchy for public health interventions can be stated [10]:

- Diseases which occur with a high prevalence/incidence/mortality rate should take precedence over those which occur at a low rate.
- Communicable diseases should take precedence over non-communicable diseases.
- Diseases which are life threatening, disabling or of long duration should take precedence over diseases which are of passing nature.
- Diseases which are easily preventable should take precedence over those which are difficult to prevent.
- Diseases which have a high cost of treatment should take precedence over diseases which have low treatment costs.

By using a combination of the above factors it is possible to come up with a prioritization scheme for the prevalent health problems in urban poor areas. The most common diseases can thus be classified into different priority levels that can be used in the models to find the allocation of certain demand regions to the available health centers. Assume that for a particular disease the occurrence rate, mortality rate, cost of treatment, preventability and degree of threat to human life are known. Then, by giving relative weights to these factors it is possible to come up with a functional form that will produce an index of criticality or urgency for treatment for that particular disease. This in turn will place the disease in a particular priority class with respect to the value of the criticality factor.

- *Effective Queuing Strategies for the Urban Poor in Health Care Provision:*

Improving the timing performance of health care organizations is important for several reasons. In most service systems the outcome of the service is greatly defined by the amount of time the customer has to wait for service. In medical service systems, time is even a more critical issue, especially for the urgent cases. The performance of an emergency center can be determined by indicators such as the number of people waiting in the queue and the time a patient has to wait till service is received, which is partly related to the availability and location of the available health centers and the management of medical work force. Waiting time in health care systems is undesirable because in most

cases delaying the treatment aggravates the condition of the patient and may create some complications. In addition, waiting is a source of stress, impatience and dissatisfaction for patients. It increases the cost of seeking medical care. Especially for the urban poor, it is an opportunity cost of loosing time from work and, therefore, sometimes can act as a barrier to health care access and capacity utilization.

Queuing statistics of the medical organization can give an idea about the quality of the service provided, which is greatly dependant on the waiting time of patients and the number of people waiting for service. So, a higher quality service would require the attainment of a pre-specified target level in these performance measures.

A concept from queuing which might be useful in health care provision is the leveling strategy. The calls from patients are first answered by a low level server –nurses or practitioners. Then, the low level server either directs the patient to a higher level server that can be a better trained and specialized physician, or handles the situation and lets the patient leave the system if it is a common type of incidence. This leveling strategy may be efficient when the high level servers, i.e. specialized medical work force, are of limited capacity. The initial service provided by the lower levels saves some time by taking care of non-serious cases and leaves time for the higher level servers to treat the patients with a more serious and vital situation. Such a strategy may enable the facilities to attain maximum utilization of their health care providers and can also increase the number of patients that can be served. In this way, the serving capacity of health care facilities will be utilized more efficiently and the unsatisfied demand, i.e. the number of patients who cannot receive health care will be decreased [4].

Marianov and Serra (2000) suggest two hierarchical location-allocation models for congested systems with a hierarchical structure [11]. Public health services, with the primary health care centers as the lower level and the hospitals as the higher level services, are one of the typical systems with a hierarchical structure. Their first model finds the minimum number of servers and their locations that will cover a region completely with a distance or time standard, whereas the second model is given as a Maximal Covering Location Model that maximizes the population covered when a limited number of servers is available. Although in hierarchical systems facilities at different levels provide different services, usually there exists a linkage -such as capacity constraints- between different levels that makes impossible to solve the location problem for each level separately. In addition, the fact that often a high-level service provides also low-level service makes the problem inseparable. Congestion –which happens when a service center is not capable of serving all of the simultaneous requests– is assumed to happen at both levels of the system putting the requests for service in a queue. Quality of service is enforced through constraints on the queue length or waiting time. For example, a constraint that sets a lower bound of α on the probability of a request being on a queue with at most b other requests (b may differ for each service level) are used in the above mentioned models to ensure quality of service. If waiting time is used as a measure of quality then the travel time to the health care center can also be incorporated into it since in most cases for urban poor people time lost in travel implies some opportunity costs in terms of time lost from work.

It is possible to introduce considerable amount of savings in time for the patients and thus increase the satisfaction and benefits obtained from health care by using effective queuing strategies like “Priority Queuing”. The location of medical facilities and the

allocation of the patients to these facilities also affect the amount of time patients have to wait in the system before being served. It is possible to classify the patients into priority classes with respect to their reason for "call" as in priority queuing (Market segmentation as discussed above might be helpful in identifying potential priority levels). Silva and Serra [4] give a formulation of The Priority Queuing Covering Location Problem, which defines separate allocations for the different priorities that may or may not coincide. In their model, the objective is to maximize population covered in different priorities. Time constraints imposed differ with respect to the priority level.

$$Max\ Z = \sum_k \sum_i \sum_j p_i \cdot X_{ij}^{\ k}$$

s.t

$$X_{ij}^{\ k} \le Y_j \qquad \forall i \in I,\ \forall j \in N_i, \forall k$$

$$\sum_j X_{ij}^{\ k} \le 1 \qquad \forall i \in I, \forall k$$

$$\sum_j Y_j = p \qquad \text{(I)}$$

$$W_j^{\ k} \le \tau^k \qquad \forall j \in N_i, \forall k$$

$$X_{ij}^{\ k};\ Y_j \in \{0,1\} \quad \forall i \in I,\ \forall j \in N_i \quad N_i = \{j \mid d_{ij} \le d\},\ \text{where}$$

$X_{ij}^{\ k}$ is 1 if demand node i is allocated to a center at j for priority k's urgencies and 0 otherwise;
Y_j is one if a center is located at j and zero otherwise;
$W_j^{\ k}$ is the average waiting time for priority class k at center j;
τ^k represents the limit imposed to the waiting times for priority k;
p is the number of centers to be located and p_i is the population of demand node i.

The Priority Queuing Covering Location Problem [4] given above by (I) assumes that the server capacities are known a priori for each center, which are used in the calculation of the average waiting times.

The allocation of the health care personnel can also be considered together with the location of the health care centers. Assume that there are L low-level health care personnel and H high-level service personnel. Then, the above model (I) can be modified as in (II) to handle the allocation of the workforce together with the location of the health centers. L_j and H_j are used to calculate the average waiting times of at health care center j.

$$Max\ Z = \sum_k \sum_i \sum_j p_i \cdot X_{ij}^{\ k}$$

s.t

$$X_{ij}^{\ k} \le Y_j \qquad \forall i \in I,\ \forall j \in N_i, \forall k \qquad (1)$$

$$\sum_j X_{ij}^{\ k} \le 1 \qquad \forall i \in I, \forall k \qquad (2)$$

$$\sum_j Y_j = p \qquad (3)$$

$$W_j^{\ k} \le \tau^k \qquad \forall j \in N_i, \forall k \qquad (4) \qquad \text{(II)}$$

$$\sum_j L_j \le L \cdot Y_j \qquad (5)$$

$$\sum_j H_j \le H \cdot Y_j \qquad (6)$$

$X_{ij}^{\ k}; Y_j \in \{0,1\} \quad \forall i \in I,\ \forall j \in N_i \quad N_i = \{j \mid d_{ij} \le d\}$, where

$X_{ij}^{\ k}$ is 1 if demand node i is allocated to a center at j for priority k's urgencies and 0 otherwise;
Y_j is one if a center is located at j and zero otherwise;
$W_j^{\ k}$ is the average waiting time for priority class k at center j;
L_j is the number of low - level health care providers assigned to center j and is integral;
H_j is the number of high - level health care providers assigned to center j and is integral;
τ^k represents the limit imposed to the waiting times for priority k;
p is the number of centers to be located and p_i is the population of demand node i.

The objective tries to maximize the population covered in all priorities. The first constraint makes sure that if demand node i is allocated to health center at j then there must be a center located at j. The second constraint makes sure that each demand node is allocated to no more than one center. The third constraint defines the number of centers to be located. Constraint number four forces the average waiting time to be less than a predetermined standard. The fifth and the sixth constraints are about the allocation of the high and low level health care practitioners to the health centers. The average waiting time in constraint 4 is found by using the underlying arrival process of the patients (rate of appearance of requests) and different server characteristics in the system.

- *Optimum Location of New Health Facilities:*

As stated above, the location of health care facilities and the allocation of patients to these facilities play an important role in improving the performance of the facilities, which is measured in terms of the waiting time before being served and the number of people waiting to be served. In this respect, a possible choice for the location model is to incorporate some queuing effects. In locating the new health facilities, the covered populations should be maximized (maximal covering location), where it is possible to define the coverage in terms of the time or distance between the home of the patient and the health care center. Most urban poor have a tendency of not risking to travel long distances due to financial transportation costs and the opportunity costs of loosing time from work. Queuing can be incorporated by ensuring that once a patient is covered by a

health center then service should be provided within a certain period of time upon arriving at the medical center with a high probability [4].

Another issue that can be considered is whether the health care providers should have fixed locations or whether it is more cost-effective to have mobile health care providers. In the latter case, when the providers are mobile, the problem transforms into finding the optimum schedule and travel path for the mobile center. Again, here concepts like prioritizing and segmentation can be utilized. A region with a higher priority would require more frequent visits and health care personnel of higher specialization. The above discussion of leveling for health care providers can also be utilized for the traveling health care providers. In this sense, highly specialized medical personnel do not need to travel through all regions. Instead, their capacity should be reserved for regions with a higher priority, which may result due to more unfavorable living conditions compared to other regions. Traveling health care providers are advantageous for the urban poor also because it would help them save from the financial costs of traveling.

In both cases, considering more than one priority may help in providing a more efficient geographic distribution of health care service. In this way, the higher level services may get low congestion levels and queuing will be shifted to the customers of a low priority.

- *Management of Health Care Providers – Specialization vs. Generalization in the Medical Work Force:*

Health provider requirements are determined by broader societal decisions about the level of commitment of resources to health care, the organization of delivery and funding for health care programs, and the level and mix of health care services. Although it is always possible to do more in terms of service delivery to meet populations' needs, whether more should be done depends on what other things have to be foregone in order to provide the additional resources.

As stated earlier, several of the vital interventions for promoting health and preventing disease are non-clinical in character, and can be effectively implemented by non-professionals like health workers. Approximately 80-90 percent of the health problems of the urban poor can be resolved without clinical intervention by taking some preventive measures.

Conclusion

The approaching health crisis of poor urban areas – mainly due to the rapid urban growth rate experienced in developing countries- could easily overwhelm health care systems and endanger the stability, sustainability and the productivity of many developing nations. Through channels of globalization this instability can reflect itself in the rest of the world in a relatively short period of time. Especially women and children -with their rising mortality and morbidity rates from environmental-related diseases- are the two most vulnerable sections of the urban poor population. This is a critical point in time for the developing country governments and international organizations to come up with effective strategies in the health sector to reduce the impending burden of disease of the poor. The way health systems are designed has a great impact on the livelihood of the urban poor

population, quality of service and the efficient utilization of health care personnel and resources.

In this respect, Operations Research offers techniques that can be applied in the design face to find the optimum or near-optimum locations of health centers, deployment of health personnel to these centers and to determine the most cost-effective allocation of budgetary or any other resources among different service types, such as preventive and curative health care services. Queuing Theory can also be incorporated into the decision models to provide the most time-efficient services to the urban poor since time-loss is a factor that carries high opportunity costs and can act as a barrier to health care access.

A final point is the fact that the development in the health systems should include strong connections with the interventions in the environmental, educational, social and economical issues in the lives of the urban poor.

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