Reviews in Infection RIF

RIF 1(1):38-41 (2010) ISSN:1837-6746

Mini Review

Impact of urbanization on parasitic infections in developing countries

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Key words: Urbanization, developing countries, geohelminthiasis, amoebiasis, malaria

Abstract

The impact of urbanization on parasitic diseases status is different in developing versus industrialized countries. In developing countries, population growth, rural-urban migration and development of urban physical environment have facilitated the spread of many parasitic diseases such as malaria, amoebiasis, geohelminthiasis, filariasis, etc. The increasing morbidity and mortality from these parasitic diseases has caused several negative consequences: decreasing economic productivity, low performance in school, increasing medical costs. However, this paper provides and discusses a brief overview of existing knowledge on the relationship between urbanization and parasitic infections by improving the understanding of how urbanization influences parasitic infections particularly in developing countries and recommends some control measures.

Introduction

In the wake of industrial reform in the 1970s, mostly in developing countries, peasants started moving into towns having in mind a prosperous and better living conditions. There began a slow but steady growth in urban populations with a boom in this first decade of the present century. Presently, the population of urban areas in developing countries is estimated at 3,000 million inhabitants [1]. This population boom led to huge human agglomerations which seem to outgrow the capacity of political and administrative systems to manage them. Urbanization, a process related to economic and political factors, has a direct bearing on the health of urban dwellers which are already confronted to serious problems such as high population densities with inadequate housing, poor or absent sanitation and water supply, weak health infrastructure, degrading and unhealthy environment with litters around houses. These are well known conditions that favour disease transmission.

There is extensive literature on parasitic diseases and their public health importance in terms of diseases and secondary effects on cognitive function, school performance, pregnancy and nutritional status of urban population in developing countries [2,3,4,5,6]. However, this paper provides and discusses the existing evidence about the links between urbanization and parasitic diseases in developing countries and it is aimed at improving the understanding of how, urbanization influences the occurrence of parasitic diseases in developing countries with a special reference to neglected parasitic infections.

1.1. Population growth and its influence on parasitic infections in developing countries

In recent years, the population living in urban settings has increased explosively. In 1950, less than 30 percent of the world's population lived in urban areas. According to the World Bank estimates in 2003, population grew to 48 percent. If trends in migration and population growth continue, urban areas will witness a remarkable shift with about 60 percent people living in urban settings in the world by 2030 and all of the features growth of the world's urban centers will occur in developing countries where health response systems are weakest [1]. The urban populations of developing countries are expected to grow from 1.9 to 3.9 billion people, while the number of urban dwellers in developed countries will remain almost unchanged. For example in Africa, a number of

megacities have emerged (more than ten million inhabitants) such cities are Lagos and Kano in Nigeria, Cairo in Egypt, Pretoria and Johannesburg in South Africa. In other megacities of developing countries, the population of Mumbai, Mexico city and Sao Paolo are now each approaching twenty million inhabitants. Urban population is a function of both rural emigration and expansion of existing city population, the relative importance of which varies by region [7]. In Latin America, metropolitan growth has largely reflected increased migration as a consequence of industrialization and the search for economic opportunities. In sub-Saharan Africa currently the least urbanized region of the world yet the region undergoing the most rapid transition, urbanization has followed rural impoverishment [8].

In developing countries, interstate war, internal conflicts and political instability has led to mass migration of people who found themselves as refugees and lived in ad-hoc interim accommodation in slums or peri-urban areas. Most of the world's 6.9 million displaced people and refugees reside in refugee camps or temporary shelters in developing countries. In these often crowded environments, where provision of sanitation, clean water, food and health care services are typically inadequate, where barriers to vectors and animals carrying infection disease are usually absent or insufficient, and where person-to-person contact is amplified, parasitic infections are common and often devastating. For example, after almost one million people fled from Rwanda to Zaire (present DR Congo) in 1994, around 500 thousand died within a month due to epidemics of cholera and dysentery which broke out in refugee camps [9]. Conditions in refugee camps also favoured the outbreak of vector borne diseases, skin infection as well as intestinal helminthiasis. Malaria epidemics are well documented in refugee camps, for instance, Afghanistan and Pakistan [10]. The course of infection anthroponotic cutaneous leishmaniasis (ACL) in an Afghan refugee settlement in north western Pakistan, in which over one-third of the inhabitants developed active lesions was thought to be, infected migrant carriers from Kabul [11]. Because urban population are characterized by much higher densities of people, poor housing, inadequate sanitation and solid waste removal, and unsafe drinking water, meaning that more people are sharing the same spaces, and diseases are much more easily transmitted.

Rapid and unplanned population growth places huge strains on a city's infrastructure. Often designed to protect the public health of a small urban elites, this infrastructure is difficult to expand to meet the needs of a much larger population, especially those living in shanty towns and slums at urban peripheries, where parasitic infections are shared among people. In a metropolitan population of Nigeria, it was reported that school children, whose parents live in slums and urban peripheries, were more prone to intestinal parasitic infection than their counterparts that live in residential areas and have affluent parents [12]. These slums and peripheries were characterized by inadequate supply of clean drinking water, poor environmental hygiene with refuse dumps that are common sight and tenuous health systems.

According to an estimation, about 50% of the world urban population lives at the level of "extreme deprivation", and about 70% in some cities [13]. At least one quarter of people living in urban areas in developing countries do not have access to safe water, and 30 – 50% of solid wastes generated in developing countries urban centers are left uncollected [14]. For example in the eastern Korogocho slum area of Nairobi, Kenya more than 100,000 people live around a dumpsite of 13-hectare, where children grow up deprived of basic services such as water and electricity and play on smelly waste ground, around rotting food, broken bottles, medical waste and much more. However, a 2007 UN Environmental Programme (UNEP) report highlighted the prevalence of respiratory and gastro-intestinal problems, skin infections among residents living close to the dumpsite [15]. Socioeconomic inequalities are rife in poorer countries, urban health care services are typically grossly over-stretched, and their provision is often distorted to cater for the needs of the rich urban elites [7]. While rural migrants may bring new infection to the city, they are themselves at higher risk of developing infection to which they have not being previously exposed.

1.2. The urban physical environment and parasitic infections.

The poor and unhygienic conditions prevailing in many cities of the developing countries are ideally suited for the transmission of parasitic infections through the air, food, water, human waste or insect-vectors. These cities have historically being great concentrators of infections. For example outbreaks of gastrointestinal and skin infection are common in urban settings. Rates of certain epidemic infections, such as acute diarrhea (the second biggest killer of children under five years old worldwide) is very high in urban communities where there is lack of sufficient housing, sanitation and clean water [16]. In most urban settlements of the developing countries, where children comprise a high proportion of the population, the impact of parasitic infections is particularly heavy. Others, less obviously hazardous features of the urban environment may also contribute to the spread of these infections. For example, distribution of sewage-contaminated vegetables from urban gardens led to the propagation of cysticercosis in Mexico City [17]. However, in a comparative study of intestinal parasitism between rural and urban areas in north central Nigeria, Ikeh *et al*. [18] found that the common practice of emptying the watery portion of filled septic tanks into the gutters, and burying the solid faecal wastes in the soil contributed to the high prevalence of intestinal parasites of the urban centres. The watery portion eventually contaminated bodies of water used by humans and the buried wastes contaminated underground surface water.

This was a very bad practice that affected the epidemiology of intestinal parasites in those urban areas.

Otherwise urbanization can positively impacts on vector-borne diseases. The expansion of urban areas can actually reduce the prevalence of parasitic infections by destroying the breeding grounds of some vectors (e.g. mosquitoes for malaria). However, it can also increase diseases by creating new opportunities for vectors and hosts to flourish. Urban areas may also encroach on rural environments where insects or arthropod vectors thrive facilitating exposure of increasing numbers of urban inhabitants to infection; for example, malaria, filariasis and schistosomiasis in parts of South America and Africa. Vectorial transmission of Chagas disease has been documented in the peri-urban shanty towns in many cities in Latin America. In metropolitan Santiago, Chile, 23% of the peri-urban substandard houses and 60% of the slums ("ranchos") were infested with *Triatoma infestans* and 15% of the captured insects were infected by *Trypanosoma cruzi*, the causative agent of Chagas disease [19]. Other infections have similarly spread from rural to urban areas. For example *Anopheles* and *Culex* mosquitoes, and *Bulinus* snails, are believed to be responsible for urban endemic foci of malaria, filariasis and schistosomiasis respectively in several tropical and sub-tropical regions [20]. In Santarem city, Par'a State (Brazil), poor quality house construction during rapid urbanization has been associated with the onset of a new zoonotic visceral leishmaniasis focus, probably due to the availability of new habitats for the vector *Lutzomyia longipalpis* combined with the presence of infected dogs [21].

1.3. Rural-urban migration

Migration of rural people can add to the urban burden of parasitic diseases in several ways. Firstly, if rural migrants travel from non-endemic areas they will be susceptible to parasitic infections that are endemic in the destination city. For example, rural migrants were reported to be at high risk of acute urban schistosomiasis in Cairo and Belo Horizonte, and of urban cutaneous leishmaniasis in Afghan cities such as Kabul [21]. Secondly, urban inhabitants may be at risk from new infections brought in by the rural immigrants. For vector-borne infections, the exact impact depends on whether:

- Migrants themselves are infected by the pathogens in question,
- The city is endemic for the disease,
- Migrants carry the vector(s) or intermediate host(s) of the disease.

As the case may be, a non-infected rural migrant may bring the infected vector or intermediate host of an infection into a non-endemic city. This vector can then contaminate the urban environment, leading to infection among city inhabitants. Outbreaks of Chagas disease, filariasis and schistosomiasis are all thought to have followed entry of their respective insect vectors or intermediate hosts into metropolitan areas. It is also possible that new species of parasites could be introduced into urban areas if suitable vectors for their transmission are already present. New species of *Schistosoma*, *Leishmania*, and filarial worms, and new zymodemes of *T.cruzi* have been described in urban areas [21]. However transmission of these parasites can only be sustained if the urban environment supports survival and multiplication of their vectors, facilitating continued spread between humans. A more complex scenario arises when an infected rural migrant, or a rural migrant bringing an infected vector, moves into a non-endemic urban area. In either cases, transmission of a disease can be initiated or increased. This has led to the creation of hyper-endemic foci of schistosomiasis in cities such as Dar es Salaam (Sudan), Harare (Zimbabwe) and Sao Paolo (Brazil). It has also facilitated the transmission of Chagas disease in the shanty towns of cities in Latin America, and probably contributed to the appearance of malaria in several African, Asian and South American cities [7].

Conclusion and Recommendations

As described in the present text, associating urbanization as a determinant factor of the propagation of parasitic diseases is an approach that can gain even more importance in the study of these diseases and of the preventive measures to their control. Plans for parasitic disease control in urban areas should be included in long-term national strategies after identification of both general and specific control measures. Since intersectoral coordination is an integral part of the urban planning process there should be participation of parasitologists, epidemiologists and environmental health personnel. However, the following measures are recommended and could be implemented for efficient control of parasitic diseases in urban areas of developing countries:

- Provision of adequate public services such as water supply.
- Implementation of weekly sanitation and drainage.
- Procurement of efficient health services including laboratories capable of diagnosis and drug supplies for correct treatment.
- Surveillance and monitoring of data derived from in-patient and out-patient health services to determine the pattern and distribution of parasitic diseases.
- Sustenance of vector control measures.

Acknowledgements

We are sincerely grateful to all authors whose articles were used for the preparation of this review.

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