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REVIEW ARTICLE

Sanitation in periurban areas of developing countries

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Abstract

The growth of periurban areas of urban cities is seen along the periphery of cities, along highways, roads connecting a city. These areas lacks in basic amenities like treated water supply, sanitation/sewerage system, primary health centre, etc. as planners were unable to visualize such growth during planning, policy and decision-making. Such growth results in loss of agricultural land, open space and ecologically sensitive habitats in and around urban areas due to lack of integrated and holistic approaches in regional planning. In developing countries, where urbanization rates are high, the growth rate of periurban areas is more. In the densely-populated periurban neighborhoods in India-like elsewhere in the developing countries-domestic liquid wastes are disposed of in latrines or septic tanks. The lack of adequate periurban sanitation provisions has grave environmental consequences that indirectly jeopardize human health. The inadequate disposal of human waste contaminates surface and groundwater with organic compounds, nutrients, and solids. The waste water joining nearby water sources causes pollution by depletion of oxygen and loss of the aquatic organisms. Ultimately makes water body dead by eutrophication process. Increase in Infant mortality rate and spreading of epidemic diseases can be observed in periurban areas due to fecal contamination. This calls for thinking on provision of sanitation services and innovative solutions. In view of the above facts, this review presents the current scenario of sanitation in periurban areas of developing countries.

Keywords: Periurban, water supply, sanitation, primary health centre, eutrophication, epidemic diseases.

Introduction

Rapid urbanization and industrialization has significantly reduced the quality of life for millions of people who live in periurban and low income settlements within cities. Lack of basic sanitation infrastructure endangers public health and natural resources, resulting in enormous loss of life and also of public/private investment. The availability of safe sanitation is a major global challenge, where more than a third of the world's population lacks access to adequate sanitation. This problem is particularly severe in periurban areas and urban slums, where lack of adequate facilities is compounded by poor access to health and education amenities.

In developing countries, the growth of periurban areas is more rapid and bigger than formal urban areas. An estimated 600 million people in urban areas of the Third World now live in life and health threatening homes and neighborhoods, primarily in periurban settlements. Lack of infrastructure, crowded, cramped housing conditions, inadequate water supply removal and safe disposal of excreta and wastewater from washing, bathing etc. have resulted in low levels of sanitation. The lack of these services threats public health and environment of periurban settles as well as the urban areas as a whole. In Asia and African countries, domestic waste water and untreated human excreta are discharged into the open space between houses, in stagnant pool of water or directed into nearby ditches, canals, streams and rivers.

The cities having more than one lakh populations are not implemented with effective collection, treatment and disposal systems. The formal cities having collection treatment and disposal systems are not effectively treating the waste and recovering the valuable by products. Moreover, as in Africa and Asia, the growing periurban areas throughout Latin America, which often make up more than 50% of a city population, lack sewerage or latrine collection system. The ineffective methods of sanitations in periurban areas are indirectly creating the conditions favorable for spreading diseases.

The health problems resulting from a lack of sanitation facilities are greater among the urban poor living in overcrowded periurban are as compared with other parts of urban area or in rural areas. Addressing of such problem is quite difficult. A recent World Bank study suggests that, in contrast to higher-income urban dwellers and some rural populations, the urban poor have a lower life expectancy at birth and a higher infant mortality rate (Bradley *et al.,* 1992). A variety of intestinal parasites is usually present in poor urban populations, with roundworms and whipworms often observed at higher levels of incidence than in corresponding rural populations. Likewise, the accumulation of wastewater as a result of the limited soil area to absorb it in densely settled urban areas has led to increased transmission of filariasis in many cities (Hardoy *et al.,* 1990).

The primary objective of sanitation programme is to improve the health by preventing the spreading of diseases but in general it has been difficult to demonstrate a causal relationship between the two. A recent WASH study (Bateman and Smith, 1991) concluded at least that sanitation interventions in urban areas had a higher health impact than do water supply interventions. In addition to threatening health, the lack of excreta management systems in Third World cities is having a tremendous negative effect on the environment contaminating surface and groundwater with organics, nutrients, and solids. Because of their current and growing size and density, and their lack of adequate infrastructure, periurban areas are the largest source of fecal contamination in cities. Men, women, and children often defecate on open ground. Their feces wash down the hillsides through various neighborhoods or through low-lying floodplains to a river or other water source. The lack of adequate sanitation systems for families living in these growing periurban areas is a major contributor to water pollution in the city. Removing and disposing of excreta in ways that prevent human contact are central to reducing the burden of disease and environmental degradation. This degradation uncontrolled and far reaching is in itself as compelling a justification for action as the impact of inadequate sanitation on health.

Urban areas of developing countries are growing faster than either the urban areas of developed countries or the rural areas of the developing world. According to United Nations data, 1.3 billion people, or approximately 25% of the Third World population, now live in urban centers; by the year 2020, it is anticipated that more than 50% of the population in the developing world will be living in cities. The estimated annual growth rate of the developing world's urban areas will range from 1.5% in Latin American cities to 4.8% in African cities. Between 75 and 90% of this growth will take place in the periurban or informal sector. Since informal urban settlers lack technical know-how and assistance, they often develop their areas haphazardly, without allowing adequate space for installing infrastructure lines. Urban settlers imparts of Africa and Asia build their houses according to village traditions, that is, patterned according to family formation, with houses directly abutting their neighbors on all sides, with no room left for service right-of-ways. The limited availability of water leads to major sanitation problems when purchasers are forced to set priorities that may compromise public health; for example, periurban families are not apt to purchase water to flush a toilet. Some periurban families have access either to a standpipe nearby or mini water supply or to water piped into the house. In all these cases, water is usually limited in quantity and leads to low levels of personal and domestic hygiene and thus favors the transmission of excreta-related infections. Typically, however, periurban settlements have a high population density often greater than 400 people per hectare.

High population density without basic infrastructure entails greater health and environmental risks than those found in rural and formal urban areas. Moreover, a growing number of periurban areas have vertical construction that is multifamily, multistory housing that increase Residents of periurban areas often does not have legal land tenure, and, in most cases, the site itself has not been legally urbanized. Therefore, governments generally do not recognize the legality of these settlements. Periurban communities overwhelmingly lack adequate arrangements for waste disposal. Wastewater from bathing and washing is typically spilled right outside shelters, where it may soak into the ground or form stagnant pools in poorly drained areas. Where sewers exist, they are virtually always open drainage canals. The ground by the side of the shelters or in alleyways serves as a frequent substitute for urinals. In general, residents have improvised sanitation systems in periurban areas to satisfy their perceived needs (like privacy and convenience) and as materials and labor become available.

Sanitation practices

Some of the most common sanitation practices in periurban areas are:

1. *Open defecation:* Men, women, and children often defecate on open ground. Their feces wash down the hillsides through various neighborhoods or through low-lying floodplains to nearby water source. Defecation occurs in open areas within the settlement, on the perimeter of the settlement, or in drainage ditches. The lack of any planned waste disposal system is characteristic of most periurban areas.
2. *Latrines:* Use of latrines is the second most common sanitation practice in periurban regions. A wide range of latrines can be found in periurban areas, including pit latrines, and ventilated improved pit (VIP) latrines. In Asia, some systems for excreta removal from latrine pits exist, either through buckets or vacuum trucks, but in other areas excreta removal is not common. Latrines in periurban areas are often poorly designed and maintained and may not be used by all family members.
3. *Pour-flush toilets/septic tanks:* In periurban settlements experiencing regular or even irregular water supplies, pour-flush toilets with soak-away or septic tanks may exist, relying either on household or community septic tanks. However, the septic tanks often are poorly maintained or undersized.

Sanitation improvements are more critical in crowded urban area because of the unique characteristics of periurban areas; the technological lessons learned from sanitation interventions in rural and formal urban areas are not always applicable to periurban sites. To date, construction of latrines has been the main sanitation intervention funded by external support agencies, including for projects in periurban areas.

Latrines, however, have been shown to have serious limitations in the periurban sector. They usually are not feasible at population densities above 250 to 350 persons per hectare, and most periurban areas have population densities above 350 persons per hectare. For this reason, technologies appropriate to periurban areas are limited. In many high-density informal settlements, there will be little, if any; space available to dig a new pit after the existing one fills up. Often, not enough space exists for even the first pit. Pit latrines also are impractical for multistory housing. In addition, soil conditions in most periurban settlements are often too rocky or too steep, contains where population densities are very high. A lack of real data makes it difficult to determine how many periurban houses lack access to sanitation systems and what kinds of systems would be most appropriate to introduce. The urban poor settle on the cheapest land, which also requires the most expensive infrastructure. It is more costly to put low-cost systems on steep slopes or in is that baseline health information usually does not exist for periurban areas. Municipal authorities usually do not keep records on periurban settlements, including information on current health status, environmental conditions, or existing sanitation coverage. In addition to this other environmental factors, such as intermittent water supply and poor drainage, interfere with accurate predictions of health effects of improved sanitation. Even pit latrines, a very low-cost option, can be more expensive to construct in periurban settlements than in rural areas contain too much clay, or have too high a water table to make latrines feasible. The consequent lack of clear information and conclusions makes it difficult to rank the desirability of improving sanitation on the basis of health benefits. Therefore, if the justification for a periurban sanitation project is improved health, it will be complicated and expensive to measure health improvement resulting from a proposed periurban sanitation project. Periurban sanitation improvements tend to evolve in rather large steps: from nothing to pit latrines to pour-flush toilets to full sewerage. Bateman and Smith (1991) WASH study showed that the proportion of children stunted in Guatemalan urban areas was directly associated with the level of sanitation service Stunting was lower in children who had access to a flush toilet when compared with those with access to latrines and to those without access to sanitary services

Environmental issues

Low-income communities which do not have adequate sanitation facilities are exposed to a high risk of infection with excreta-related diseases. Children under the age of 3 are particularly susceptible to diarrhoeal diseases. Older children and adults are likely to be infected with intestinal worms, most commonly the human round worm (*Ascaris lumbricoides*) and the human hookworms (*Ancylostoma duodenale* and *Necator americanus*).

This disease burden is generally very high in low-income periurban communities, that infant mortality in Bangladesh, for example, is higher in periurban areas than in rural areas and both infant and adult mortality in urban Brazil is higher in poor areas than in non-poor areas. The lack of adequate periurban sanitation provisions has grave environmental consequences that indirectly jeopardize human health. The inadequate disposal of human waste contaminates surface and groundwater with organic compounds, nutrients, and solids.

The wastewater joining nearby water sources causes pollution by depletion of oxygen and loss of aquatic organisms. Ultimately makes water body dead by eutrophication process. Reducing such environmental contamination via improved sanitation technologies can be more compelling to development decision-makers than is improving general health, as can be seen in the following example from Kumasi, Ghana. A year study by the World Bank (Whittington *et al.,* 1993) on sanitation in Kumasi estimated that 24,100 cubic meters of fecal waste was generated by Kumasi 600,000 people every month. The types of sanitation technologies used by the Kumasi population included public latrines, bucket latrines, flush toilets (into septic tanks), pit latrines, and nothing (bushes). Independent of the type of sanitation technology or disposal system, the World Bank study showed that 21,600 cubic meters of the total fecal waste (90%) eventually flowed untreated into the underground aquifers and streams. The environmental effects of such a quantity certainly would impress upon decision-makers the need to re-examine the sanitation system on hand.

Public participation and NGOs role

The involvement of local community plays a key role in the success of periurban projects. The basic information, ideas and suggestions will helps in the success of sanitation. This also leads to cost reduction, more effective operation and maintenance of the system. The Working Group on Urbanization (WG/U) of the Water Supply and Sanitation Collaborative Council, an international organization, recently reviewed 271 documents describing 67 periurban water supply and sanitation (WS and S) projects. Thirty one of the 67 projects were reported to have been successful; 19 of these attributed a major role in their success to citizen participation. Failure of others is due to lack of common social composition in periurban areas can make organizing for community participation difficult. The periurban community comprises people of different ethnic groups, different languages, different religions and wide range of incomes. The heterogeneous nature of community involvement from beginning will increases the complexity of sanitation improvements approaches. Success stories of Public participation and NGOs role are reported from Zambia and Kenya in the effective implementation of sanitation in periurban settlements.

There is widespread belief that periurban sanitation projects are essentially technical in nature, with social aspects, including community participation, considered less important for a projects success. Consequently, the technical departments of the implementing agency have much more power and status than those dealing with social aspects, if the latter exist at all (Moser, 1992 in Voices from the City, 1993). WASH studies have shown that health benefits associated with periurban sanitation projects require that changes in hygiene behavior accompany infrastructure improvements (Yacoob, 1992).

Innovative approaches

To solve such problems, town planners (officials responsible for water, housing, sanitation and health) need to have innovative and integrated programs towards solving the water and environmental sanitation problem. The innovative approaches are ecological sanitation (EcoSan) and Dewat system. However, in recent years, a number of promising approaches to periurban sanitation have emerged, including community managed toilet, washing and bathing complexes, component sharing and pit-emptying enterprises. EcoSan technologies take the principle of environmental sanitation a step further. Ecological Sanitation (EcoSan) means keeping our surroundings clean and safe and preventing pollution. It is a type of sanitation in which human waste is separated into its solid (faecal) and liquid (urine) parts. After this separation, the pathogens within the human waste can now be destroyed and the waste used as soil additives, due to their richness in crop nutrients. Therefore, EcoSan has advantages over the traditional sanitation approaches of drop and keep (latrine) and the drop and flush (WC). The latter wastes water, while the former is known for spreading sanitation related diseases like cholera and dysentery. EcoSan type of sanitation because this system takes care of improved sanitation while conserving water. Ecological Sanitation (EcoSan) is a closed-loop system, which treats human excreta as a resource. Using the technique, faecal materials are separated from urine, and then the excreta are processed locally on site until they are free of pathogens. Thereafter, the sanitized excreta may be recycled into the agricultural soils as fertilizers. By closing nutrient loops, environmental cleanliness, soil fertility and crop yield per unit space may be improved. The EcoSan technique, therefore, replenishes soil nutrients, and improves sanitation and health of communities while conserving the environment. In turn, EcoSan can contribute to poverty alleviation. Unfortunately, the technique is not popular and is likely to face resistance due to social cultural beliefs, knowledge and attitudes of the local communities. DEWATS stands for “Decentralized Wastewater Treatment Systems. The DEWATS framework is tailored to improve sanitation conditions in densely populated urban areas and to provide reliable low-cost sanitation and wastewater treatment solutions.

The DEWATS-CBS (Community Based Sanitation) approach is an alternative option that fills the significant “gap” between inappropriate on-site sanitation (e.g. absorption pits) and the shortcomings of sewerage collection and treatment systems. Within the CBS approach communities are able to make their own informed demands. They are educated about the connection between sanitation, hygiene and disease and are encouraged to organize the operation and maintenance of sanitation infrastructure. DEWATS and CBS as a viable sewage and sanitation option in areas where, neither individual on-site systems nor centralized sewerage systems can fulfill the need of stakeholders for basic sanitation.

Analysis of numerous implementations in Asia and Africa has shown that three types of water-based CBS Systems or combinations are preferred by communities.

1. Simplified sewerage systems for settlements low-diameter sewerage system that collects and discharges household-wastewater from houses of one settlement into low-maintenance wastewater treatment plants.
2. Shared septic tank system in which a number of houses are connected to one septic tank. System (1) and (2) are appropriate for smaller and larger poor areas where houses are privately owned and households are willing to invest to upgrade sanitation hardware.

Selection of CBS-systems and its components depends on existing requirements and capabilities of implementing communities. The basic CBS system consists of a toilet component, a collection component, a treatment component and a disposal/re-use component project implementation depends on the active cooperation of local communities, governments, NGOs and the private sector.

Conclusion

There is an acute need for sanitation in poor periurban areas. Sanitation is the key infrastructure component which is required to reduce the unacceptably heavy toll of excreta-related disease. Yet sanitation coverage in urban areas is currently decreasing and urbanization, actually periurbanization is increasing. In many (but obviously not all) periurban situations the sanitation technology of first choice is simplified sewerage. The two principal reasons for this, which are that it can be cheaper than on-site sanitation systems and that it is often institutionally easier–that is to say, water and sewerage authorities accept it more readily than on-site systems simply because it is a sewerage system and therefore automatically part of their mindset. Water shortage, poor health, sanitation and hygiene problems in periurban areas are thought to be associated with inadequate town planning, deficient political framework and absence of participatory planning among others.

In periurban areas, the various societal factors like individual citizens, priorities cost, institutional capabilities and legal constraints may limit wide range of acceptable, appropriate, sanitation interventions. Appropriateness of on-site systems in periurban areas will be subject to the user perception of land availability, the maturity of the community, income levels, and other perceived priorities. Lower-cost technologies require more labor from community members than do other technologies. Many periurban sanitation project designs require communities to provide much of the construction labor, including digging pit latrines, digging trenches for sewage pipes, or building on-site latrine superstructures. Many low-cost technology sanitation schemes also require the community to play a significant role in the operation and maintenance of the systems, including cleaning out latrines, unplugging small-diameter sewer pipes or emptying septic tanks.

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