

Health and social benefits from improving community hygiene and sanitation: an Indian experience

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India is a country where Atomic Age and near Stone Age people co-exist. On one hand India has achieved development in many areas, but on the other hand there is still the practice of open defecation and manual cleaning of human excreta from bucket privies by scavengers. National sanitation coverage is only about 34% meaning that 66% of the population practises open defecation. Such unhygienic conditions lead to infections and high mortality and morbidity in the community. Low sanitation coverage could be due to lack of affordable sanitation technology and awareness or motivation. Although the sewerage system was introduced in India long ago, high operational and maintenance costs have prohibited it from being implemented in most towns and cities. Similarly, the cost of a septic tank is beyond most people, and disposal of undigested sludge from septic tanks remains a problem. In contrast, the pour-flush two-pit toilet (known as Sulabh Shauchalaya) is a low cost, socially acceptable and appropriate technology that does not require scavengers to clean the pits. Sulabh has converted and constructed over 1.2 million such toilets throughout India, making 240 towns scavenger-free. Liberated scavengers are thereby available to take up vocational training in various market-oriented trades enabling self-employment. The on-site/decentralised systems of waste management has improved community health and hygiene, particularly in socially deprived groups, and reduced the financial burden of local government.

Keywords: Open defecation; bucket privies; scavengers; twin-pit toilet; Sulabh Shauchalaya; community health; hygiene.

Introduction

Many developing countries have taken effective measures to increase sanitation facilities to people. The global coverage of population with access to excreta disposal facilities has increased from 55% (2.9 billion people served) in 1990 to 60% (3.6 billion) in 2000. Still, at the beginning of 2000 there remained 2.4 billion people in the world who were without access to improved sanitation. In India, the coverage increased from 21% to 31% during the same period (Global Water Supply and Sanitation Assessment 2000). Although there is appreciable gain in access to sanitation facilities by population in absolute number, the percentage coverage appears to be modest due to high population growth. Burgeoning population, rapid urbanisation, congregation of urban poor in slums without safe water supply and sanitation facilities, and increasing resource constraints have all led to rapid deterioration in quality-of-life and community health, resulting in poor economic growth in developing countries like India. The situation is likely to become further aggravated unless further steps are taken to improve

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sanitation through intersectoral co-ordination between different authorities, and innovative and appropriate technology for safe management of human waste.

In India one of the challenging problems is how to abolish the inhuman practice of manual scavenging. Out of the total population of 1,027 million in India, according to 2001 census, the rural population is 742 million (72.2%) and the urban population 285 million (27.8%) (Census 2001). The urban population has been growing at a much faster rate and that of urban slums at a faster rate still due to growing industrialisation and urbanisation. There are about 736 million people in the country who lack basic sanitation facilities. About 49% of urban population in January 1997 (Economic Survey 2001) had access to water flush toilets—28% had sewerage connections and 21% had low cost sanitation facilities. By March 2000, the sanitation coverage in urban areas was reported to be 60%, half of which was connected to sewerage and septic tanks and the remainder were availing low-cost sanitation facilities (National Commission on Population 2001). The coverage in rural areas was barely 20%. In India, the majority of the people use unsanitary bucket privies or resort to open air defecation.

Sanitation is a broad term that includes disposal of human excreta, waste water, solid wastes, and domestic and personal hygiene. Human excreta are the cause of many enteric diseases, such as cholera, diarrhoea, dysentery, typhoid, infectious hepatitis and hookworm. Studies reveal that more than 50 infections can be transmitted from diseased people to healthy ones by various direct and indirect routes from human excreta, which cause nearly 80% of sickness in developing countries.

This high rate of infection and transmission has appalling health implications. Worldwide, 2.2 million people die annually from diarrhoeal disease (including cholera) associated with contaminated water supply, sanitation and hygiene. Most are children in developing countries who are under 5 years of age. Improved hygiene and sanitation help reduce sickness from diarrhoea considerably. Intestinal worms infect about 10% of the population of developing countries, which could be controlled through better sanitation, hygiene and water supply. As stated in the WHO and UNICEF Joint Monitoring Report (Global Water Supply and Sanitation Assessment, 2000), 200 million people are infected with schistosomiasis worldwide, out of which 20 million suffer seriously. Implementation of basic sanitation facilities can reduce the incidence of disease by up to 77%. Sanitation facilities help to keep in check transmission of many faecal–oral diseases by preventing human excreta contamination of water and soil. Epidemiological evidence suggests that sanitation is at least as effective in preventing disease as an improved water supply.

Low sanitation coverage in India is primarily due to insufficient motivation/awareness by people and a lack of affordable sanitation technology. Most of these people are from lower socio-economic groups and are not aware of the health and environmental benefits of sanitation. It is still not seen as a high priority, resulting in absence of people's participation. The lack of choice of toilet design, area-specific technologies, inadequate supporting delivery systems and absence of trained masons, skilled workers and technical manpower is also important in why there is low coverage. Additionally, by tradition, Indian society and culture value personal hygiene, but give little importance to a clean and healthy community environment. Human excreta are regarded as the most hated object, and anything connected with latrines is considered so defiling because of psychological and religious taboos that a person is supposed to take a bath immediately after using a latrine and before going into a kitchen. Sanitation is regarded as a matter of individual initiative and not as a collective obligation of the community. In this socio-cultural background, environmental sanitation has been given the lowest priority.

Sanitation technologies

In developed countries, the standard solution for the sanitary disposal of human waste is through sewerage systems. Due to severe financial constraints and exorbitant maintenance and operational costs, sewerage is not viewed as the answer to solve the problem of human waste management in India. Modern sewerage was first introduced in the world in London in 1850, followed by New York in 1860. Calcutta in India was the next city in the world to have this privilege in 1870, yet only 232 towns and cities out of 4,700 have partial sewerage systems.

In developing countries neither the government, local authorities nor beneficiaries can afford the capital expenditure or maintenance costs of a sewerage system. Moreover, a sewerage system requires skilled people and good management for operation and maintenance. Natural resources also have to be taken into account, as to clear away human excreta with each flush sends more than 10 l of clean water down the drain. This is particularly true as large dams and irrigation systems are constructed to move huge quantities of water only for it to be flushed down into an expensive sewerage system, all of which ends up polluting rivers and ponds. Most of the rivers in India today are highly polluted because of the domestic sewage load from cities, resulting in health hazards and the destruction of aquatic flora and fauna.

Sewerage systems are built to protect public health but badly managed sewers can become a serious health hazard, leading to potentially serious outbreaks of waterborne diseases. Due to high operational and maintenance costs, a sewerage system is not really affordable in developing countries like India. Septic tank systems are also expensive and require large volumes of water for flushing. However, as there is shortage of drinking water in most urban areas of the country, water has to be conserved. Other problems are associated with septic tanks, such as the need for periodic cleaning and disposal of sludge. Effluent disposal is also a potential source of foul smells, mosquito breeding and health hazards if not properly dealt with. Although the design of septic tank latrines was developed nearly 400 years ago and introduced in India about 150 years ago, less than 20% of the houses have septic tank toilets even in urban areas.

Septic tanks have not been widely accepted, partly due to high costs and other limitations. Furthermore, after the tank is filled, it contains fresh and degraded excreta mixed with water. Since there is no mechanical means easily available to empty the tank, it is cleaned manually by scavengers, which is an unhygienic process. The Government of India has forbidden the practice of scavenging, but unless the technology of the septic tank is completely banned, it would be very difficult to ban the practice of scavenging. Even after the septic tank is emptied mechanically, sludge effluent has to be kept in ditches for at least 2 years before it becomes free from pathogens, which is a very cumbersome and time-consuming process. Generally, such untreated human waste along with water is discharged into an open drain or onto the soil surface causing nuisance, health hazards and environmental pollution.

Sulabh Shauchalaya (twin-pit pour-flush toilet)

Sulabh Shauchalaya is a pour-flush water-seal twin-pit toilet, which is technically appropriate, socio-culturally acceptable and economically affordable. It uses indigenous technology and can easily be used to construct latrines and from local materials and using local labourers. The toilet provides all the health benefits for safe disposal of human excreta on-site, requires only 1.5–2 l of water for flushing, thus conserving water, and does not need the services of scavengers to clean the pits.

Two-pit pour-flush toilet

There are two pits, the size and capacity of which vary according to the number of users (Fig. 1). Each pit is generally used for 3 years, after which use it is switched to the other. If one of the pits becomes full during this time excreta are diverted into the second pit. Within a 2-year rest period, the sludge is digested and becomes almost dry and pathogen-free, and is thus safe for handling as manure. Digested sludge is odourless and is a good manure and soil conditioner. It can be dug out easily and used for agricultural purposes. The Sulabh Shauchalaya can also be constructed on the upper floors of buildings, and easily upgraded and connected to sewers if these are introduced into the area. To date, Sulabh has constructed more than one million individual household toilets in different parts of the country.

Sulabh public toilet complexes

Provision of public toilet complexes in public places and in slums on a pay and use basis marked an important point for Sulabh's community health, hygiene and environmental sanitation. As far back as 1878, the then Bengal Government had passed a law to set up toilet facilities in Calcutta, but for various reasons such facilities were either not provided or poorly maintained. From 1878 to 1973, public toilets were not seen by the authorities as being practical. The concept of implementation of public toilets and their maintenance on a pay and use basis, originated in 1974 in Sulabh and was highly successful throughout the country. For some years, studies were made of the attitudes and reasons why people did not use public toilets in cities and towns. Results showed that the unsanitary and neglected state of public toilets deterred people from using them. It was felt that along with the community toilets, if facilities for bathing and washing clothes were also provided and above all kept clean, then people would have no hesitation in using them and paying for their use.

To date, Sulabh has constructed more than 5,500 of these toilet complexes in various parts of the country, where maintenance is provided both day and night. These complexes are located in public places, including bus stands, hospitals, markets and in slum areas. For the construction, operation and maintenance of these complexes, the organisation plays the role of catalyst and partner between official agencies and the users of the toilet complexes.

Sulabh public toilet

The Sulabh complexes are manned by attendants day and night, and have separate enclosures for men and women. For washing hands, soap powder is provided for users. The system of operation and maintenance of community toilets evolved by the organisation has proved a boon for local authorities in their endeavour to keep the towns clean and improve the environment. This is a unique example of partnership of local authorities, non-governmental organisations and the community. The cost of individual Sulabh toilets varies from US\$10 to US\$1000 making them affordable for every economic group of people.

Community toilets linked with biogas plants

Recycling and re-use of human excreta for biogas generation is an important way of ridding health hazards from human excreta. After a series of experiments, the organisation developed a more efficient design of biogas plant in collaboration with the Ministry of Non-conventional

Energy Sources, government of India (Report, Government of India 1992). During biogas generation, most pathogens are eliminated from the digested effluent by anaerobic conditions inside the digester, thereby minimising health risk in using it as manure. Biogas technology from human waste therefore has multiple benefits—sanitation, manure and bioenergy.

Sulabh biogas plant linked with public toilet

Based on the Sulabh model, over one hundred biogas plants of 35–60 cu m capacity have been constructed by Sulabh in different states of the country so far. Biogas from human excreta contains 65–66% methane, 32–34% carbon dioxide and residual amounts of hydrogen sulphide and other gases. Biogas is being used in a number of ways including cooking, lighting through mantle lamps, heating and electricity generation. A public convenience used by about 2,000 people daily produces approximately 60 cu m of biogas, which can run a 10 KVA generator for 8 h a day, producing 65 kWh of energy. The electricity generated from the biogas is being supplied for use in places such as in toilet complexes, bus stands and public parks.

Sulabh effluent treatment (SET) technology

Biogas produced from human excreta is used for a variety of purposes—cooking, lighting, heating and electricity generation. As well as biogas, digested effluent can be used as fertiliser, as it contains a high percentage of nitrogen, potassium and phosphate. At the same time, though, its aesthetically bad colour, odour and presence of pathogens limits its use for agricultural and horticultural purposes.

As Sulabh maintains more than 5,500 public toilet complexes throughout the country, over one hundred of which are linked to biogas plants, the organisation deemed it necessary to make the effluent free of odour, colour and pathogens so that it could be used safely for agricultural and aquacultural purposes. After a series of experiments, the organisation developed a new and convenient technology that turned effluent of human excreta from biogas plants into colourless, odourless and pathogen-free liquid manure. The technology is based on filtration of waste water through activated charcoal followed by ultraviolet light.

The water from human waste has a Biological Oxygen Demand (BOD) of about 200 mg l⁻¹ that is reduced to less than 10 mg l⁻¹ after treatment, making it safe for agriculture, aquaculture or discharge into any expanse of water (Fig. 2). It can also be used, for example, to clean the floors of public toilets in drought-prone areas, where Sulabh had until then to purchase water for maintenance of public toilets, thereby saving a substantial amount of money.

Duckweed based waste water treatment

A major problem of waste-water treatment methods is that none of the current technologies have a direct economic return. Technologies currently available are unaffordable due to high capital and maintenance costs, which means that local authorities are generally not interested in taking up treatment of waste water. This causes severe health hazards and environmental pollution. Throughout the country, of about 4,700 towns and cities only about 232 have a sewerage system and these are only partial. Most of the untreated waste water is discharged into rivers or other bodies of water. In rural areas, it is common practice to discharge waste water and sullage without even collecting, treating or even re-using waste water or sullage, as people are generally unaware of the technology.



Fig. 1. Two-pit pour-flush toilet.

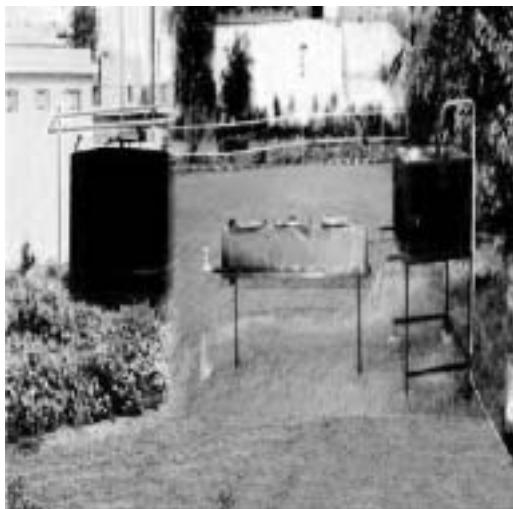


Fig. 2. Sulabh effluent treatment (SET) technology to treat waste water.

Sulabh has successfully developed and demonstrated projects on duckweed based cost-effective waste-water treatment in rural as well as urban areas with direct economic return from pisciculture. Although duckweed grows widely in ponds and ditches, the near complete absence of knowledge in this area means that the potential of duckweed, including its nutritional value and economic benefits, had not been exploited earlier.

Duckweed, a small free-floating and fast growing aquatic plant, has tremendous ability to reduce BOD, Chemical Oxygen Demand (COD), and the amount of suspended solids, bacteria and other pathogens in waste water. As it has a high content of proteins and vitamins A and C, it is a nutritious feed for fish, poultry and animals. The yield of fish increases by two to three times when fed with duckweed compared with conventional feeds in ponds. Reduction of BOD and COD of effluents varies from 80 to 90% at the retention time of 7–8 days. Several projects have been implemented based on the technology, and the Central Pollution Control Board, Government of India, has made guidelines on the use of duckweed for waste-water treatment (Central Pollution Control Board Guidelines 2001).

Liberation and rehabilitation of scavengers

The inhuman practices of manual cleaning and carrying human excreta from bucket privies by ‘scavengers’ – a particular class of people, has been practised in India for a very long time. The two-pit pour-flush toilet, as outlined above, does not require scavengers to clean the pits as human excreta turns into an odourless, pathogen-free, semi-solid humus-like structure after a 2-year resting period, making it suitable for use in agriculture. The beneficiaries themselves can remove such manure with ease thereby making its use economical. The scavengers, newly liberated from this practice, are re-training in various market-oriented trades, becoming shorthand-users and typists, tailors, carpenters, electricians, drivers, beauticians, clothing designers, etc., enabling them to be self-employed or to obtain a job in government or private organisations. To date, Sulabh has made 240 towns scavenger-free in India, by liberating more

than 60,000 scavengers from their degrading employment. From these, 4,000 have been trained in different trades by the organisation.

Health and sanitation education

Sulabh realised that mere construction of toilets will not go far in improving sustainable sanitation—sanitation must be supported by elementary health education. Most people, particularly those from lower socio-economic groups, are not aware of health and environmental benefits of improved sanitation, or of the availability of affordable technological options or government efforts and programmes. General awareness and community involvement in social programmes enables the development of self-reliance and confidence in the community resulting in sustainable benefits.

Sulabh has set up primary healthcare centres at some of the community toilets where health and hygiene education is given to slum dwellers. The organisation has also launched a programme to train women in sanitation and health. So far, it has trained more than 6,000 women from different slum areas in Delhi and 1,000 women volunteers from urban slums of the neighbouring states in various aspects of health hygiene and sanitation. The main focus has been on health check-up camps, immunisation, prenatal care, family planning services, safe food and drinking water, safe environmental sanitation and health education. The awareness and participation programme, including health check-ups and rural sanitation, has been taken up in Budhgaon, Sangli (Maharashtra), Ranichauri, New Tehri (Uttaranchal) and 12 villages near Bhondsi (Gurgaon in Haryana State). The programme of people's participation with awareness training on health, hygiene and sanitation was also taken up under Yamuna Action Plan in collaboration with Japan Bank of International Cooperation (JBIC) and Public Health Engineering Department, Haryana Government, in Faridabad and Gurgaon, and also in collaboration with WHO in the rural areas of Punjab, Uttar Pradesh, Rajasthan and Madhya Pradesh.

Realising that the women have by far the most important influence in determining household hygiene practices and in forming the habits of their children, Sulabh ensures the participation of women at every stage of implementation of the sanitation programme. One of the thrust areas in the educational curriculum of Sulabh Public School, established specially for the children of scavengers, is to teach at a very young age the benefits of sanitation and personal hygiene. Educating these children early has a far-reaching impact on them and their families.

Public–private partnership in quality service delivery

The sustainable and affordable technologies developed by the organisation have attracted various agencies towards management of human waste. All the technologies developed by Sulabh have been partly or fully supported by different departments of the Government of India. The 'pay and use' basis of public toilets is annually saving a lot of money for local authorities in maintaining the complexes. It is now a one-off investment by local government, and maintenance of the toilets is carried out by contributions from users.

Financial viability of projects

As human excreta are considered such an unpleasant topic in this society, it is difficult for any one to consider financial viability for a project related to its disposal. However, Sulabh made it financially viable. The cost of construction is met by the local authority and the

maintenance of toilet blocks and day-to-day expenses are met by charges from the users. Sulabh does not depend on external agencies for finances and meets all the financial obligations through internal resources. Not all the toilet complexes are self-sustaining, particularly those located in slums and less developed areas. The maintenance of such toilet complexes is cross-subsidised by income generated from toilet complexes in the more busy and developed areas.

Elimination of stigmas and taboos

Until recently, there was a social stigma and psychological taboo associated with handling of human excreta. This was probably due to the fact that only people in the lowest socio-economic groups were involved with the job. By the efforts of Sulabh and because of the financial viability, people from higher socio-economic groups are now competing for the construction and maintenance jobs for public toilets without any psychological taboo or inhibition. The Sulabh methodology provides a good economic return and job opportunities.

Employment opportunity

In total, there are 50,000 volunteers working with Sulabh, including technologists, managers, scientists, engineers, social scientists, doctors, architects, planners and other non-revenue staff. Sulabh has a 30-year maintenance guarantee for the toilet complexes it has constructed, and therefore provides regular employment for everybody associated with this work. Those people associated with construction are almost in full employment too.

Conclusion

It is well known that improving sanitation has a direct affect on the health and in turn the productivity and quality-of-life of ordinary people. In India, improvement of sanitation is equally related to the improvement of social standing of scavengers. The on-site treatment of human waste and waste-water treatment is the best-suited option to tackle the problem effectively. Furthermore, any technology that has low operational and maintenance costs and an economic return can provide a greater advantage for a developing country like India.

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