Utilities Policy xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Utilities Policy

journal homepage: www.elsevier.com/locate/jup

The public health benefits of urban sanitation in low and middle income countries

Sandy Cairncross

Professor of Environmental Health, London School of Hygiene and Tropical Medicine, Keppel St, London WC1E 7HT, United Kingdom

ARTICLE INFO

Keywords:
Sanitation health excreta

ABSTRACT

A review of the so-called "non-health" benefits of urban sanitation shows them to be important indicators of human wellbeing, and more important to the householder than those which benefit health in the narrower sense of preventing disease. The health benefits are surprisingly difficult to measure, but recent advances suggest that they are greater than previously thought.

1. Defining interventions and benefits

Before we consider the relationship between sanitation and public health, we need to define what we mean by health and also by sanitation. "Sanitation" in many contexts is taken to include not only excreta disposal but also a broad range of environmental health measures including water supply, drainage, solid waste management, and even mosquito vector control. In this paper, the word 'sanitation' is used in its narrow sense of excreta disposal.

However, I believe there is insufficient recognition of the fact that environmental health interventions have multiple outcomes, and so I shall include what are sometimes called the "non-health" benefits of sanitation, although it could be argued that some of them are indeed beneficial to health. All of them represent contributions which sanitation can make towards human well-being, beyond the simple reduction of cases of infectious disease.

These other dimensions to the benefit of sanitation include comfort, convenience, privacy, security, social status and aesthetic benefits. To some extent they can be summed up by the word dignity. The owners and users of domestic sanitation are usually more acutely conscious of these benefits than they are of any improvement to their health which sanitation might bring. Many of the diseases related to poor sanitation have chronic, insidious and diffuse effects, such as the anaemia caused by hookworm; others, such as diarrhoea, occur only periodically and few people can remember whether they had more episodes or fewer in the last year compared with previous years. The end result is that most people do not notice if their health improves as a result of improvements in sanitation. They also often lack the knowledge of disease causation and transmission to see a link. By contrast, they will certainly notice if, after years of defecation in the open after dark, they are able to practise it in a secure private cubicle with a roof.

2. Gender

There is a strong gender dimension to these "non-health" benefits. In many settings, women are under strong social pressure not be seen relieving themselves, or even going to the place where they will relieve themselves or returning from it. This can mean that they are effectively imprisoned by daylight, obliged to wait until dark before venturing out. That wait can itself lead to secondary health hazards such as urinary tract infections. It is not only shame and a sense of propriety that drive women's behaviour here, but frequently they are exposed to harassment and a very real risk of assault, rape and even murder. In recent years there have been a number of accounts in the international news media of the murder of young women in India who were on their way to a defecation area.

2.1. Gender-based violence

The risk of gender-based violence associated with defecation is not limited to backward rural areas. It has been found almost everywhere people have looked; around community toilets in urban areas in Nairobi, Kenya (Anon, 2010), in Kampala, Uganda and in a number of cities in India (Sommer et al., 2014). For example, Biran et al. (2011) found in Bangalore that usage of community toilet blocks by males was double that by females, although the population served was evenly divided by gender. Female usage was found to fall off very sharply with distance from the home, and female residents confirmed that the reason for their low usage was the risk of harassment and assault. The pattern was the same, whatever the arrangements made for the management of the toilet block.

It is not yet clear whether the presence of the sanitation facilities increases the amount of gender violence, or whether they simply

E-mail address: sandy.cairncross@lshtm.ac.uk.

https://doi.org/10.1016/j.jup.2018.03.001
Received 1 November 2017; Received in revised form 28 February 2018; Accepted 1 March 2018
0957-1787/ © 2018 Elsevier Ltd. All rights reserved.

precipitate a tendency which is latent in the culture. A general toolkit to help local organizations to address the problem has been produced by 28 humanitarian and development organizations led by WaterAid (House et al., 2014), but it is based more on reasoned extrapolation than documented managerial experience.

What is needed now is to test the claims of a few veteran Indian NGOs to have almost vanquished the problem by mobilising the local community to provide security. If they are substantiated, they should be documented and the NGOs asked to provide training to staff of some of the other NGOs promoting shared, communal or collective sanitation.

Sanitation is important to women, not only at home but also at school. When school toilets are absent, insufficient in number, poorly maintained, or lacking in privacy, girl pupils will be reluctant to use them. On the other hand, toilets become all the more necessary as puberty brings the need for a private space for menstrual hygiene management. Whatever the reason why a girl needs a toilet at school, if it is not available to her she is likely to go home. She is unlikely to return to school that day, and the next day she will have the added difficulty of catching up and possibly the embarrassment of explaining her absence. It is little wonder that for these reasons girls are more likely to be absent from school than boys, and ultimately more likely to drop out of school completely. There is a body of anecdotal evidence that schools sanitation can significantly increase female enrolment and attendance (Bartram and Cairncross, 2010). Few curriculum improvements could obtain that result.

2.2. Significance of "non-health" benefits

Few would dispute that the prevention of violence and the education of women contribute towards public health, in which case "non-health benefits" is a misnomer. However, these factors are often neglected by sanitation planners by comparison with the importance given to conventional definitions of health benefit. Even if conventional benefits such as the reduction of episodes of diarrhoea, and of the prevalence of intestinal worms are uppermost in the minds of decision-makers, it is essential to remember that they will not count for much in the minds of local people, in persuading them to adopt sanitation (Cairncross, 1992; Jenkins, 1999).

In order to reach the sustainable development goals for the coming decades, sanitation programs will have to leverage the investment of individual households, at least in the low income countries. In order to develop that process, we need to learn much more about what makes sanitation attractive to ordinary people. Studying the so-called "non-health" benefits is a step in that direction.

3. Health benefits

The following example should help to illustrate the way sanitation-related pathogenic organisms are collected in a sewerage system. Imagine a typical tropical town in a low income country. Unusually, all the households are connected to the town sewerage system. Table 1 shows in the left-hand column a list of typical pathogens found in faeces, and the next column shows a typical prevalence for each pathogen. That is, the proportion of the population which is infected with it. The next column shows the results of clinical studies of infected people, in which the number of organisms of the pathogen per gram of faeces is multiplied by the typical daily faecal weight of about 200 g to give the total number excreted daily.

3.1. "Sanitary hydrology"

Now we estimate the quantity of waste water produced per person as roughly equal to their water consumption. If everybody is connected to the sewer system, they must be also connected to the water supply; otherwise the sewer system would not function. From that we deduce a water consumption (or at least a wastewater production) of about 100 L per person per day. We divide the total number of pathogens by the total volume of wastewater to obtain the concentration of the pathogens in the wastewater. For example, with a cholera prevalence of about 1%, and the daily production of 10^8 vibrios per infected person, we would expect a concentration of 10^6 in sewage produced by an infected person, and hence of 10^4 in sewage from the population as a whole. There is a final adjustment to make; it is estimated that roughly 90% of the excreted pathogens do not pass through the sewer system (Feachem et al., 1983). The bacteria and viruses tend to die along the way, and the worm eggs tend to be removed by sedimentation, particularly if there are septic tanks between the households and the sewer network. With this adjustment, we estimate a concentration of 10^3 vibrios per litre, which corresponds to the value in the table. To summarise:

<u>*Cholera vibrios*</u>
Number per infected person 10^8 per patient.
Divided by water consumption 10^6 per contaminated litre.
Adjusted for prevalence 10^4 per litre overall in house.
Adjusted for die-off in sewers 10^3 per litre overall in sewer.

Table 1
Possible concentration of pathogens in wastewater from a tropical town.
Source: Feachem et al. (1983).

Pathogen	Prevalence of infection (%)	Total daily per infected person	Concentration per litre of sewage[a]
Enteroviruses	5	10^8	5000
Salmonella	7	10^8	7000
Shigella	7	10^8	7000
Vibrio cholerae	1	10^8	1000
Entamoeba histolytica	30	10^7	3000
Ascaris	60	10^6	600
Hookworms	40	10^5	40
S. mansoni	25	4×10^3	1
Taenia saginata	1	10^6	10
Trichuris	60	2×10^5	120

[a] Assumes 90% die-off in sewer system, septic tanks etc.

The results were reported in the last column of Table 1. Looking down the list, there are several points to be made. First, though the calculation and underlying assumptions were rough and ready, the results are borne out by studies of the microbiology of wastewater (e.g. Mara and Silva, 1986). Second, they show that wastewater is highly infectious material. These are not figures for a cholera hospital or the effluent from an infected household. These are averages for the community as a whole, and they show how the sewer system draws together all the pathogens which may be present in the community. Third, the figures for viruses and bacteria are higher than those for intestinal worm parasites; this is partially countered by the larger infectious dose for the viruses and bacteria. Fourth, these figures are for wastewater which has typically been settled, at least in a septic tank, and so is likely to be almost transparent. Clarity or turbidity of the wastewater is no guide to its infectiousness.

3.2. The Bradley classification of excreta-related diseases

From that initial crude model, we can move on to a classification of sanitation-related diseases (Feachem et al., 1983) which discriminates those on which sanitation has a greater and lesser impact. In order to do this, we need to introduce a number of conceptual refinements. The first is to distinguish among faecal oral infections (often called the diarrhoeal diseases) between those with relatively high infectious doses (mainly bacterial) and those with relatively low ones (mainly viral or protozoal). The lower infectious dose pathogens are more likely to be transmitted in relatively hygienic environments anyway, and therefore are less affected by the presence or absence of excreta disposal facilities.

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات