

Keynote paper

From Semmelweis to Global Handwashing Day: What's the latest on hygiene promotion?

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The study of hygiene has an important place in the history of epidemiology. One of the first ever statistical investigations of death and disease was carried out on rates of death in childbirth in the Vienna General Hospital around 1847. Ignaz Semmelweis noticed that patients attended by student doctors who had recently carried out autopsies died at a much higher rate than those attended by midwives. He correctly surmised that something was being transferred on the hands of the doctors. He solved the problem by instituting a handwashing regime in the hospital (Semmelweis, 1861). Just a few years later John Snow conducted his famous investigation into the causes of cholera in London. His investigations incriminated not just contaminated water supplies but the poor hygiene practices of the people living around the Broad Street pump (Snow, 1855). Today modern living conditions including sewerage, piped water supplies and, above all, the widespread adoption of commercially promoted soap have gone a long way towards eliminating infectious disease in rich countries, helping to reduce mortality rates from infection to 5% of all deaths. However, in Africa a full 65% of deaths are due to infections, while the figure is 35% in Asia (WHO, 2002). Today new generations of epidemiological studies help us to understand these disparities, and continue to point to the importance of good hygiene in preventing infectious disease.

In this chapter we will look at the epidemiological evidence, not all of which has moved on from the days of Semmelweis and Snow, for the importance of good hygiene practices. However, if we want to improve the situation, it is not enough to understand the links between hygiene and disease; we also need to understand why people behave the way they do. Hygiene is deeply embedded in local culture, in habits learnt since childhood and in the settings in which such behaviour is practiced. To change it we need to learn from behavioural scientists, in particular psychologists and anthropologists. As well as looking at the epidemiological evidence concerning hygiene and health, this chapter also provides a short introduction to what is known about how to change hygiene behaviour, and points to where to go to find out more.

The epidemiology of hygiene

One of the biggest causes of child death is diarrhoeal disease. Indeed it is rarely appreciated that these infections still kill more children than malaria, HIV and measles combined (UNICEF & WHO, 2009). Yet, with a little more investment, almost all of these deaths could be prevented. According to a recent review by the World Bank, promoting hygiene is the single most cost-effective means of preventing disease that we know of (Jamieson *et al.*, 2006).

Hygiene, however, is a complex subject which covers a large variety of practices including safe stool disposal, food hygiene, safe disposal of wastes, child care practices, washing, bathing and handwashing. Not all of these practices are as important for health as others, and promoting all of them is impractical and possibly unnecessary. How can we decide which of these practices most need improvement? In an ideal world epidemiologists would have carried out trials of interventions to improve different practices and gauged the effect on the incidence of

diarrhoeal disease. Though some of these practices have been well studied, sadly, for others the state of our knowledge has hardly advanced since the days of Semmelweis and Snow.

Table 1 summarises the evidence for the importance of handwashing with soap, food hygiene, stool disposal, surface cleaning, and waste disposal (Curtis *et al.*, submitted). Public health practitioners increasingly look to the published evidence when they make decisions about what policy to adopt. While the best source of evidence is the randomised



Figure 1. Stimuli used to probe for different handwashing motives (affiliation)

controlled trial of an intervention, when this is not available they look to whether the impact is plausible, whether modelling studies suggest a significant risk, and whether observational studies have established a link between the practice and a disease outcome. In the case of the different hygiene practices, it can be seen that while all practices (except perhaps waste disposal) are highly likely to have an impact on diarrhoea based on plausibility, there is only limited evidence about food, stool, surface and animal hygiene.

While it is highly plausible from the perspective of the faecal-oral transmission of pathogens that most of these practices could cause disease, the safe removal of rubbish does not immediately interrupt the transmission of major and common diseases. Many microbiological risk modelling studies have been carried out to gauge the risks of poor food and surface hygiene, but almost all of these concern Europe or the USA, and almost none have been carried out in the poor environments where the risks are greatest. The fourth column of the table concerns observational studies, which show strong connections between poor hand and

stool hygiene in developing countries. However, this only demonstrates a link, and cannot prove that the link is causal. Amazingly, there seem to be almost no randomised controlled trials of food hygiene, stool or waste disposal and those few on surface hygiene in developed countries proved inconclusive. This does not mean that these practices are not important for health, only that we cannot be sure of their impact because too few studies have been conducted.

The table shows how much work epidemiologists still have to do in figuring out the links between hygiene and disease. It also shows that there is coherent and converging evidence that handwashing with soap can have a significant impact on diarrhoea rates. A large number of reviews have collated this evidence. The most recent concluded that handwashing with soap can reduce diarrhoeal disease by 48% (Cairncross *et al.*, 2010). Ejemot found that handwashing could reduce diarrhoea by 30%, however, in the studies that specified soap use the reduction was 43% (Ejemot *et al.*, 2008, Curtis, 2008). A review by Fewtrell *et al.*, also found a 43% reduction (Fewtrell *et al.*, 2005),

and our earlier review found a 43 - 48% reduction in diarrhoeal risk (Curtis & Cairncross, 2003). While the studies on which these results were based were not all of excellent quality, this represents consistent evidence that handwashing with soap (HWWS) can reduce diarrhoeal risk by about 45%.

Handwashing with soap can also prevent other health problems. It reduces the risk of respiratory infections by about 23% (Rabie & Curtis, 2006, Ensink, 2004). Handwashing by mothers and birth attendants was associated with a 40-44% reduction in neonatal mortality in a recent study in Nepal (Rhee *et al.*, 2008). Handwashing prevents trachoma and ascaris infection (Fung & Cairncross, 2009) and is an effective control measure in pandemics such as SARS (Fung & Cairncross, 2006, Schemann *et al.*, 2002) and Pandemic Flu (Jefferson *et al.*, 2008).

Hence, the epidemiological evidence points to handwashing with soap being one of the most important measures that families can take to prevent disease. So why is this simple measure not universally practiced? If we are to change such ingrained behaviours we first need to understand them.

Understanding hygiene behaviour

Hygiene behaviour is almost as old as life itself. Almost every animal behaves in such a way as to minimise its risk of getting eaten by parasitic life forms such as worms, microbes and viruses. Fish and primates, for example, keep their skins clean and healthy and free of

parasitic worms and flies. Lobsters, bullfrogs and mice keep away from others of the same species that show signs of illness, reindeer and caribou migrate to avoid infecting their young with parasites from heavily dunged grazing grounds, some insects fling their frass away from the leaves they are eating, fish also defecate away from their grazing grounds and birds remove faecal sacs from nests. Badgers change their bedding and chimps have been seen to engage in penile hygiene after sex (Curtis, 2007). Humans engage in the same behaviours, keeping themselves and their environments free of disease-causing agents. Hygiene thus is part of our biology; behaviour that we indulge in instinctively, independent of how much, or how little, we have learnt about germs.

Much of this behaviour is driven by the motive of *disgust*, an innate adaptive system that has evolved to cause us to behave in ways that help us to avoid disease (Curtis & Biran, 2001). However, hygiene is not just a matter of disease avoidance. By being clean people demonstrate their good manners, in effect by not forcing their own emanations or possible infections on others. People clean and tidy themselves and their environments also to impress others – because dirty people are often disrespected and treated as if they are of low *status*. Another motive for being hygienic is to *attract* others. Adolescents at the age to become interested in sex become major consumers of hygiene products and occupy bathrooms for far longer than when they were younger. Hygiene is also a matter of *comfort*. Having sticky, clingy or smelly materials on one's body is uncomfortable and produces the

Table 1. Summary of evidence connecting different hygiene practices with diarrhoeal disease

Hygiene practice	Plausible	Modelling	Observation	RCTs ¹
Handwashing with soap	Strong	Strong	Large	Large
Food hygiene	Strong	Only developed countries	Inconclusive	-
Stool disposal	Strong	-	Large	-
Surface cleaning	Yes	Only developed countries	Inconclusive	Inconclusive
Waste disposal	Weak	Limited	Large	-

1 Randomised Controlled Trials are a rigorous way of determining whether a particular intervention is effective. Participants are randomly assigned to the intervention (e.g. a drug, a health promotion campaign) or the control group and the outcomes for the two groups are compared.

desire to wash it off. Mothers also care for and protect their children; keeping them clean and hygienic is a *nurturing* activity. People often behave hygienically for no other reason than that it is what everyone else is doing - we call this motive *affiliation* because it serves to reinforce membership in social groups. All of these motives (*disgust, status, attraction, comfort, nurture, affiliation*) might be important for handwashing. People might also practice handwashing simply out of habit, or they might do so as part of a long term plan to keep themselves and their families healthy.

We explored the various motives that people have for being hygienic in 11 formative research studies in Africa (Ghana, Tanzania,

Uganda, Madagascar, Senegal, Kenya) Asia (India, China, Vietnam, Kyrgyzstan) and Latin America (Peru). Formative research involves trying to understand why people behave as they do as a way of determining how best to encourage people to change their behaviour (Curtis *et al.*, 1997).

Among a variety of research techniques, the studies employed structured observation to find out how often people were really washing their hands with soap (as opposed to asking people, which hugely overestimates actual practices (Biran *et al.*, 2008)). Table 2 shows that on average only 17% of people in these samples (largely representative of the countries/regions as a whole) were washing their hands with soap at the key moment after

defecation. Practices were not much better at other key occasions.

It was encouraging, however, to see that handwashing with plain water was a relatively common habit and could therefore be used as a building block to getting people to wash with soap.

The studies then used a variety of qualitative and quantitative research techniques to dig into people's motives for handwashing. One approach was to show people pictures depicting the different potential motives for handwashing that we discussed above (see Figures 1 to 3).

We found evidence that all of these motives were relevant to handwashing in the study

countries. *Disgust* was a particularly powerful motivator of handwashing – but only when people felt that their hands had become contaminated in the toilet. They often saw water as sufficiently purifying to remove this contamination. *Affiliation* also turned out to be key: as one Ugandan mother said: “washing hands to fit in is very common with us here”. Though *status* and *attraction* were important for general hygiene, they were less so for handwashing because, as mothers explained, handwashing is generally a private behaviour; people can rarely tell if you have washed your hands or not. *Nurture* was an important motive for handwashing, not so much for the children's health, but mothers cared deeply about their children's future

Table 2. Observed rates of handwashing with soap at key occasions

Country	N	HWWS after toilet (%)	HWWS after cleaning child (%)	HWWS after cleaning up child stools (%)	HWWS before feeding child (%)	HWWS before handling food (%)	HW with water only after toilet (%)
Ghana	500	3	2	-	1	-	39
India-Kerala	350	42	-	25	-	-	-
Madagascar	40	4	-	-	12	-	10
Kyrgyzstan	65	18	0	-	-	-	49
Senegal	450	23	18	-	-	18	-
Peru	500	14	-	-	6	-	-
China- Sichuan	78	13	-	16	6	-	87
China- Shaanxi	64	12	-	-	16	-	14
Tanzania	30	13	13	13	4	-	33
Uganda	500	14	19	11	6	8	44
Vietnam	720	-	14	23	5	-	51
Kenya*	802	29	35	38	13	15	57
Average		17%	13%	19%	5%	13%	45%

*The Kenya survey took place during a cholera epidemic which inflated handwashing rates



Figure 2. Stimuli used to probe for different handwashing motives (nurture, disgust)

success as social beings and wanted them to have good manners. However, if a small child was crying, the *nurture* motive would militate against handwashing, as a mother would want to run and comfort the child, and not stop on the way to wash her hands. *Comfort* was also described as important by mothers, who would always use soap to wash hands when it was needed to remove grease, oil, fish or other adherent dirt. This meant that hands were more often washed *after* meals rather than *before* them. *Fear* of disease only seemed to motivate handwashing when there was a clear and present danger from cholera or Avian flu, for example. Otherwise, the notion of possible diarrhoeal disease in children at some future date that might or might not be dangerous remained an abstract concern, in the realm of book learning emanating from outsiders to the culture. It had little intrinsic relevance or power to motivate handwashing at the key moments when hands were contaminated.

Habit, however, was a key factor in handwashing practice. Those few who were handwashers generally learnt it at an early age from their families and had been practicing it ever since. The habit was so ingrained that it was automatic, and did not require thinking about (Aunger *et al.*, 2009).

It thus became clear from the studies that educational approaches about germs and diarrhoea risk were unlikely to lead to an increase in handwashing. Indeed, in a trial in rural India we found no evidence of improvements in handwashing behaviour from using an educational approach concerning germs and disease risk (Biran *et al.*, 2009). Most mothers already knew about disease risk from not washing hands – but they still did not do it. We concluded that the powerful drivers of *disgust* and *affiliation* – i.e. doing like everyone else, following the norm – would probably work best to motivate handwashing, as well as *comfort* and *nurture*.

Some of these ideas were incorporated into a national handwashing campaign for Ghana. A television commercial used the idea that there was unseen contamination on hands after visiting the toilet (*disgust*) and that this would be transferred to the child’s food (*nurture*) by showing a mysterious stain on hands transferring to the child’s meal (www.globalhandwashing.org/resources/multimedia.php). This had a powerful impact nationally, leading to rates of reported HWWS before eating climbing by 41% and after the toilet by 13% (Scott *et al.*, 2007).

Other evidence points to disgust being an important driver of handwashing behaviour. A study in Australia found that posters depicting graphic contamination worked better than educational messages to get people washing hands in a public toilet (Drummond *et al.*, 2009). Disgust messages also worked to get both men and women washing hands in a public toilet in the UK (Judah *et al.*, 2009). In this study *affiliation* was the most powerful motive – where a message saying: “is the person next to you washing hands with soap?” worked better than any other overall.

For the future the challenge remains to demonstrate the best ways to improve handwashing behaviour in the settings where it is most important; in Africa, Asia, Latin America and the Pacific. Table 3 summarises what we think are likely to be the best approaches based on the evidence we have gathered about handwashing and from other types of behaviour change campaigns.

Of course, however much people are motivated to wash hands with soap, they cannot practice it if, for example, they do not have soap or water. The formative research studies showed that 97% of households did

have some sort of soap present on the day of the interview. The problem was that the soap was used for washing bodies, clothes and dishes, but not for hands. Similarly people had water available for other purposes but rarely used it for handwashing. A minority of mothers complained of the cost of soap and water, but recognised that the sums involved were much smaller than many everyday expenditures which were less vital for family wellbeing.

The studies also brought to light the inconvenience of soap as a tool for handwashing. It is difficult to hold and wash at the same time, it can slip out of hands and get dirty, it can be eaten by pigs or crows, it can be stolen or misused by children and it can become impure (*‘apavitra’* in Hindi) after contact with toilet activities. Some agencies have begun to search for enabling technologies, such as the tippy tap or other means of supplying soap and water more conveniently (Devine, 2010). For example, the Water and Sanitation Program’s (WSP) Global Scaling-Up Handwashing Project (HWWS) in Vietnam has been testing prototype handwashing station designs and has found that the mechanics of handwashing stations are complex and a universal design should not be assumed. The station design, presentation and ease of operation are all key factors affecting usage and thorough pilot testing is therefore essential (Devine, 2010). In our view a complete redesign of the means of cleaning hands at low cost is warranted. Commercial approaches may be best suited to resolving such problems.

Considerable experience in handwashing promotion has been gained by working with, and learning from, commercial soap manufacturers such as Unilever, Colgate-

Table 3. Some examples of motives and tactics that should be expected to work well in getting people to practice handwashing with soap (HWWS)

Motive	Tactic	Example	Notes
Disgust	Make mothers feel that their hands are contaminated	Depict contamination, use graphic images of faecal matter	Disgust has to be handled carefully so as not to turn people off
Affiliation	Make mothers feel that ‘everyone is doing it’	Pledges in public to wash hands with soap, houses with badges – ‘this is a handwashing household’ Buddy system in school - kids help remind each other	Pledges need to be specific-when exactly to handwash for example. Important to never say how rare handwashing is, as this will drive rates even further down
Nurture	Remind mothers to teach their children good manners	Head teacher sends letter home describing school handwashing campaign and asking mother for support	Get habits ingrained early. In teaching HWWS mothers learn to do it themselves

Palmolive and Procter and Gamble. They have proved ever-willing to collaborate on HWS programs and see that serious commercial benefits can be obtained by selling more soap and, at the same time, saving lives. They are inventive, creative, professional in their marketing and often able to mobilise effectively and quickly at national level when development agencies often lag slowly behind. In particular, commercial marketers are expert at briefing professional creative agencies to ensure that they come up with distinctive and powerful communications that really can change behaviour on a large scale.

A good example of joint public-private working has been the advocacy efforts devoted to Global Handwashing Day which is celebrated



Figure 3. Stimuli used to probe for different handwashing motives (status)

every 15th October in over 80 countries. All of the efforts of epidemiologists and behavioural scientists to better understand the problem of handwashing and to come up with effective solutions would be wasted without such efforts, which have raised the global profile of handwashing and enabled ever-increasing resources to be devoted to its promotion.

In summary, we have seen that epidemiologists since the days of Snow and Semmelweis have been aware of the importance of hygiene for public health, and their work has shown that handwashing is possibly one of the most important protective practices. However, far more studies are still needed to understand the importance of other hygiene practices such as safe stool disposal and food hygiene in developing countries, where we still know little more than we did in the nineteenth century. We have seen that behavioural scientists, too, have an important contribution to make, since without understanding the drivers of hygiene behaviour we cannot develop strategies to change it. Finally, we have seen that public and private actors can sometimes join forces to multiply their efforts at hygiene promotion and advocacy so that we can eventually reach the goal that every child lives in a household where they are protected from infection through safe hygiene.

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