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Editorial: **Handwashing with soap – a new way to prevent ARIs?**

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In the early part of the twentieth century, British and American sanitary engineers and epidemiologists, impressed by the beneficial effects of water supply on child mortality, also discussed with some curiosity what came to be called the Mills–Reinicke phenomenon. By this they referred to the surprising fact that the reduction in child mortality accompanying improvements in water supply was greater than what could be accounted for by the fall in mortality caused by enteric, waterborne diseases. A satisfactory explanation was never found, but with the continuing decline in mortality caused by infectious disease and the passing of the decades, the question was forgotten. An unexpected explanation has now appeared and it results from recent work on handwashing.

Ever since Semmelweiss documented the efficacy of handwashing in the prevention of puerperal fever in the nineteenth century (Semmelweiss 1983), this simple measure has been an important weapon in the public health armamentarium. Its importance has been recognized by all categories of health workers for over a century, although recent research in British communities (Curtis *et al.* 2003) suggests that it is not practised as often as it should be. Its importance in the prevention of diarrhoeal diseases has been underlined by a recent systematic review showing that the simple act of washing one's hands with soap can reduce the risk of diarrhoea by nearly half, and of life-threatening diarrhoea by more than half, in both developed and developing countries (Curtis & Cairncross 2003).

Handwashing thus turns out to have a greater impact on diarrhoeal disease than even water supply and sanitation (Esrey *et al.* 1985), although of course a convenient water supply makes handwashing easier to practise and hence more likely. Indeed, it has been confirmed by observation in developing countries that mothers of young children are more likely to wash their hands at critical moments if they have a piped water supply (Curtis *et al.* 1995).

Diarrhoea still kills more than two million young children every year (Kosek *et al.* 2003), while most mothers, in both developing and developed countries, fail to wash their hands adequately after faecal contact. This makes handwashing and its promotion an intervention with enormous potential impact on public health.

Hardly anyone ever thought that it might be effective not only against diarrhoeal diseases, but also against that other major killer of children in the developing world – the acute respiratory infections (ARIs). Although respiratory infections cause nearly four million deaths each year (WHO 2002), mostly of children, most of the literature on the control of ARIs is about promoting appropriate care-seeking behaviour for sick children, rather than reducing transmission. It is thus inherently curative, rather than preventive. Although indoor air pollution has been identified as an important risk factor, no intervention proven to reduce exposure to it has been successfully implemented on a large scale (Bruce *et al.* 2000).

An indication of the degree to which professionals were unaware of any connection between handwashing and respiratory infections is given in a paper by Barros *et al.* (1999) in which a distinguished team reports on a study of risk factors for ARI and diarrhoea in Brazilian childcare centres. They studied handwashing as a risk factor for diarrhoea, but admitted ruefully that, 'for respiratory infections, no modifiable characteristic with intervention potential was identified,' although they had not analysed the data to check for any possible connection between handwashing and ARI.

It thus came as a major surprise to many observers when a recent study by the US Navy showed that handwashing could reduce the risk of respiratory infections by 45% among young recruits under training (Ryan *et al.* 2001). The sample size was very large (more than 44 000 in each exposure group) which lends weight to the findings. Military discipline helped to ensure compliance. However, many specialists still see measures like handwashing for the prevention of faecally transmitted diseases such as diarrhoea as completely distinct from the control of infections transmitted in airborne droplets, when 'coughs and sneezes spread diseases'.

In fact, there are two possible links. In the following two paragraphs on the mechanisms for these, I have drawn heavily on a piece written by Prof. Ron Eccles of the

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Common Cold Research Centre at Cardiff University, for the website of the International Scientific Forum on Home Hygiene (Eccles 2003).

The first link is that the pathogens which cause diarrhoea can also cause respiratory symptoms. This is true particularly of the enteric viruses, such as those which cause 'gastric flu'. Unlike most enteric bacteria, enteric viruses are invasive and if they cause irritation to the epithelial cells in the gut they are also more likely to irritate the epithelial cells in the lungs. It follows that the viruses emitted when we cough may also be found in our faeces. Indeed, in some species such as ducks, influenza is known to be transmitted by the faecal route rather than by aerosol (Shortridge 1997).

The second connection is that both respiratory and enteric pathogens are often transmitted on surfaces and that the surface we most often use to inoculate ourselves with infection is the skin of our hands. For example, in one study (Corley *et al.* 1987) children aged 4–8 years were trained not to touch their nose and eyes so frequently, and this led to a 47% reduction in laboratory-diagnosed common cold infections. We know that viruses such as the cold virus can remain viable on surfaces for several hours (Sattar *et al.* 1993), that the number needed to cause infection can be very small, and that people can pick up virus particles on their hands by touching objects and surfaces contaminated by aerosols from infected people (Ansari *et al.* 1991).

Anecdotal evidence from the recent severe acute respiratory syndrome (SARS) outbreaks also tends to confirm the view that a more intimate contact is needed for transmission than simply being present in the same room, train or aeroplane as a SARS victim. Many of the cases have been among those caring for SARS patients. There is also reason to suspect that the sewage system of a block of flats in Amoy Gardens in Hong Kong played a key part in the outbreak which occurred there.

It may also be no coincidence that SARS originated in southern China. The area is well known for its intensive duck and pig rearing, which is believed to have helped other viruses to cross the species boundary in the past. The agriculture of rural China is also well known for its intensive use of human and animal excreta. Those applying the excreta to the field often become heavily contaminated and few of them wash their hands. China's unhygienic agriculture may thus have played a part in the transmission of the early SARS cases.

The link between handwashing and ARI is more than a hypothesis for speculation. A quick search of the literature found six studies, all showing that handwashing reduced the risk of ARIs to a significant degree. However, all were conducted in industrialized countries (Rabie 2003), where most diarrhoeal disease is of viral aetiology. If the link is caused by only the first of the two mechanisms described above, one might not expect handwashing to have as great an impact in poor communities and developing countries, where bacteria and protozoa prevail among enteric pathogens.

Does handwashing reduce the risk of ARIs in developing countries? That is now a major question for public health research. In the face of such significant grounds for hope, the recent decision by the UK Medical Research Council (MRC) *not* to fund a randomized controlled trial to answer it, which had passed its initial selection procedures, seems bizarre. As the trial funds are ring-fenced, it cannot be explained by the MRC's current cash crisis (Macleod 2003). Fortunately, another trial is under way. Unfortunately, it is funded by a soap manufacturer, but the preliminary results are promising.

If, as is to be hoped, that trial confirms that the promotion of handwashing in poor communities can significantly reduce the risk of ARIs, then we may at last have an explanation for the Mills–Reinicke phenomenon: that water supplies improve hand hygiene and reduce child mortality not only from diarrhoea but also from respiratory infections. We may also have in our hands an intervention which allows us to reach the millennium development goal of reducing child mortality by 2015.

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