

PREVENTION OF THE SPREAD OF INFECTION – THE NEED FOR A FAMILY-CENTRED APPROACH TO HYGIENE PROMOTION

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Infectious diseases circulating in the home and community are a continuing and significant burden on the health and prosperity of the European community. They could, however, be significantly reduced by better standards of hygiene. Across Europe, public health is currently structured such that the separate aspects of hygiene in different settings (food hygiene, personal hygiene, handwashing, pandemic flu preparedness, patient empowerment etc.) are dealt with by separate agencies. If efforts to promote hygiene at community level are to be successful in changing behaviour, we need a concerted family-centred approach to ensure that a basic understanding of infectious disease agents and their mechanisms of spread, together with an understanding of a risk-based approach to hygiene, are promoted as part of the school curriculum and as part of public health campaigns. Alongside this, we also need unambiguous communication with the public on issues such as the hygiene hypothesis and environmental issues.

Introduction

The last two decades have seen infectious diseases moving steadily back up the health agenda, prompting new emphasis on strategies for prevention and control. Increasingly, this includes strategies to reduce the spread of infection within the family at home, and in their social and work lives outside the home.

In the event of a flu pandemic, it is likely that hygiene will be a first line of defence during the early critical period before mass vaccination becomes available. 'Global Preparedness' means that respiratory hygiene needs to become part of our daily lives already before such an event; the evidence suggests that not just protection from coughs and sneezes, but also hand and surface hygiene play a part in reducing the spread of respiratory infections such as colds and also influenza [1,2]. Whereas at one time there was a feeling that it was only a matter of time before we could 'close the book' on infectious diseases, experience now shows that, as soon as we begin to get one pathogen under control, another emerges. Indications are that poor hygiene is a contributory factor in the spread of pathogens such as norovirus, *Helicobacter pylori*, *Legionella* and *Campylobacter*, pathogens which were largely unheard of before the 1980s.

Across Europe, healthcare-associated infections (HCAs) are no longer seen as a nuisance, but as a major barrier to delivering health. In addition, there is acceptance that controlling infections such as methicillin-resistant *Staphylococcus aureus* (MRSA), *Clostridium*

difficile and norovirus is a community as well as a hospital problem [3]. Hospital managers now realise that managing HCAI is hampered by people (new patients, visitors and healthcare workers) walking into their facilities who are silent carriers of these organisms, and that one of the key aims is containing these infections at the source in the community. Hygiene is also recognised as key to tackling antibiotic resistance. Good hygiene means fewer infections, fewer patients demanding antibiotics from their general practitioner, and thus fewer resistant strains developing and circulating in the community. Reducing the reservoir of carriers in the community reduces the risk of these strains being carried into healthcare facilities by new patients.

Across Europe, governments are under pressure to fund the level of healthcare that people expect. Although shorter hospital stays mean reduced hospital costs, the gains are likely to be undermined by inadequate infection control associated with care at home. Across Europe, up to one in five people living at home have impaired immunity to infection and need special care [1]. Those at risk include the growing elderly population, patients discharged earlier from hospital as a result of shorter hospital stays, and patients undergoing outpatient treatments such as chemotherapy, or patients with indwelling catheters.

The 1990s saw rapid increases in the incidence of food poisoning, and finally a call to action to reverse this trend. Although this has been achieved in many European countries, levels of food-borne disease remain unacceptably high. 'The Zoonoses Report', published by the European Food Safety Authority (EFSA) and the European Centre for Disease Control and Prevention (ECDC) in 2007, estimated that one third of populations in developed countries are affected by food-borne diseases every year [4]. The 2003 World Health Organization (WHO) report concluded that about 40% of reported food-borne outbreaks in the WHO European Region occur in private homes [5]. The potential for food poisoning at home is indicated by the prevalence of food-related pathogens in products purchased from retail premises. The ECDC review estimated that *campylobacter* were most commonly detected in fresh poultry meat, with an average of 35% positive samples. *Salmonella* was most commonly found in fresh poultry and pork meat, with 5.6% and 1.0% positive samples. Chapman et al. showed that 0.4-0.8% of meat products purchased from butchers in the United Kingdom (UK) were positive for *Escherichia coli* O157 [6].

Obtaining a true picture of the burden of gastrointestinal infections circulating in the community is difficult. Surveillance systems mostly focus on food-borne disease, the data coming mainly from large outbreaks in restaurants, hospitals etc, whilst sporadic cases, particularly milder infections in the home go largely unreported. Community-based studies carried out in the UK [7] and the Netherlands [8] suggest that food-borne infections represent only a fraction of the total burden of gastrointestinal infections. The 2003 WHO report stated that, of the total outbreaks reported in Europe during 1999 and 2000, 60 and 69%, respectively, were due to person-to-person rather than food-borne transmission [5]. The UK community-based study, carried out between 1993 and 1996, estimated that only one in 136 cases of gastrointestinal illness is detected by surveillance and that, for every one reported case of campylobacter, salmonella, rotavirus and norovirus, another 7.6, 3.2, 35 and 1,562 cases, respectively, occur in the community. The incidence of non-food-borne infections in the UK is estimated at around 4.5 million cases per year, the largest proportion of which are norovirus infections, which are transmitted easily from person-to-person within community groups [9].

It is often assumed that milder respiratory and gastrointestinal infections are relatively trivial, but pathogens are increasingly being implicated as contributory factors in the development of cancers and other chronic conditions which can manifest at a later date [1]; examples include *Helicobacter pylori* (peptic ulcer disease) and *Campylobacter jejuni* (Guillain Barré syndrome). Food-borne illness is estimated to result in chronic sequelae in 2-3% of cases. A European Commission report [10] cites evidence of chronic disease, such as reactive arthritis, following 5% of salmonella infections, and 5% of *E. coli* O157 infections progressing to serious, sometimes fatal, complications.

Developing a risk-based approach to home hygiene

The International Scientific Forum on Home Hygiene (IFH) (www.ifh-homehygiene.org) was established in 1997 with the aim of developing an evidence-based approach to home hygiene, and promoting this approach to scientists, opinion-formers, policy-makers and community health professionals. As part of our work, IFH has developed an approach to home hygiene based on risk management [1,11]. This involves identifying the critical control points for preventing the spread of infectious diseases in the home. Risk management is the standard approach for controlling microbial risks in food and other manufacturing environments, and is becoming accepted as the optimum means to prevent such

risks in home and hospital settings [12]. A risk-based approach has also been adopted in developing the WHO Global Patient Safety Challenge to promote hand hygiene in healthcare facilities. The central concept 'My five moments for hand hygiene' focuses, not just on getting people to wash their hands, but on getting them to do it at the right time and in conjunction with other critical control measures [13].

Applied to the home, the risk-based approach has come to be known as 'targeted hygiene'. Targeted hygiene starts from the principle that pathogens are introduced continually into the home, by people (who may have an infection or may be asymptomatic), contaminated food and domestic animals, but also sometimes in water, or via the air. Additionally, sites where stagnant water accumulates such as sinks, toilets, waste pipes, or items such as cleaning or face cloths readily support microbial growth and can become primary reservoirs of infection, although those are mostly bacterial species which only represent a risk to vulnerable groups [14]. In many homes, there will also be at least one family member who is more susceptible to infection for one reason or another.

Within the home, there is a chain of events, as described in Figure 1, which results in transmission of infection from its source to a new recipient. To an extent, we can limit the exit and entry of pathogens from and into the body, but the link that we have most control over is the 'spread of pathogens'.

Risk assessment is based on assessing the microbiological data related to each stage of the infection transmission cycle in order to identify the critical control points for preventing spread of infection. To identify these points, the frequency of occurrence of pathogenic contamination at individual sites and surfaces is assessed, together with the probability of transfer from that site such that family members may be exposed. This means that, even if a particular site or surface is highly contaminated, unless there is significant probability of transfer from that site, the risk of exposure is low. This approach allows us to rank sites and surfaces (Figure 2) according to the level of risk; this suggests that the critical points are the hands, together with hand and food contact surfaces, cleaning cloths and other cleaning utensils, which form the 'superhighways' for spreading pathogens around the home such that healthy family members or the food they eat become exposed.

Although this is a useful rule of thumb ranking, it is not constant. Toilets, baths, basins etc were invented for the purpose of dealing

FIGURE 1

The chain of infection transmission in the home

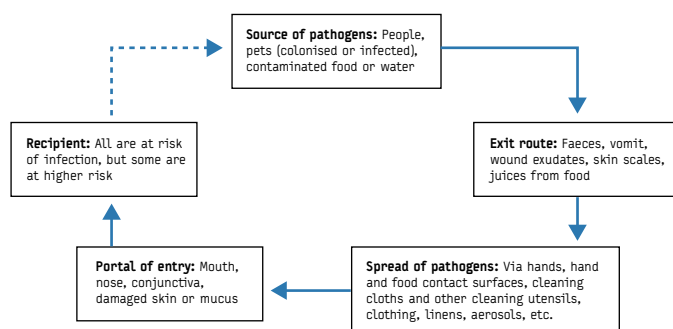
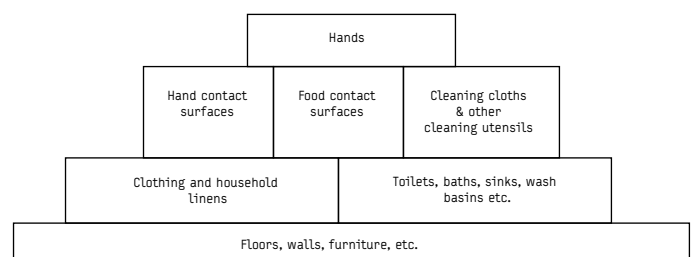


FIGURE 2

Ranking of sites and surfaces in the home based on risk of transmission of infections



with human waste, but this does not mean that they are zero risk areas, they still have risks associated with them, particularly when someone in the home has sickness, diarrhoea, or other contagious infections. Although floors, however dirty they may appear, are assessed as relatively low risk, the risks increase where a pet animal and a small child share a floor area, or where a floor surface is contaminated with vomit or faeces.

Targeted hygiene also means applying a suitable hygiene procedure at appropriate times to interrupt the chain of infection transmission. Since the infectious dose for many common pathogens such as campylobacter, norovirus and rhinovirus can be very small (1-500 particles or cells) [1], one must argue that, in situations where there is risk, a 'hygienic cleaning' procedure should be used which eliminates as many organisms as possible from critical surfaces [1]. Hygienic cleaning can be done in one of two ways, either by detergent-based cleaning with rinsing or by using a disinfectant/cleaner which inactivates the pathogens in situ. In many situations (e.g handwashing) a 'hygienically clean' surface can be achieved by soap and water alone, but recent studies suggest that this process is only effective if accompanied with thorough rinsing [15-17]. Wiping a surface with a cloth (or mop) will merely move organisms around the surface and onto the cloth and hands to be transferred to other surfaces. This means that in some situations we should not be afraid to recommend the use of a disinfectant. Waterless hand sanitizers should also be recommended for situations where access to soap and water is limited. To ensure elimination of most pathogens, clothing and household linens should be laundered either at 60°C or at 40°C using a bleach-containing laundry product [18].

The key to targeted hygiene is that it recognises that good hygiene is not a 'once weekly deep down clean', it needs to be an ongoing part of our daily lives where hygiene measures are targeted where and when necessary. Targeted hygiene also makes sense in that it offers the means to address issues such as the hygiene hypothesis because it maximises protection against infectious microbes whilst otherwise allowing normal exposure to non-harmful microbes.

As part of our work in promoting hygiene, the IFH has produced a set of 'Guidelines for Home Hygiene' together with 'Recommendations for selection of suitable hygiene procedures' [18,19]. These are based on the risk-based approach, and cover all aspects of home hygiene including food hygiene, general hygiene, personal hygiene, care of pets etc. IFH has also produced a teaching resource on home hygiene which presents home hygiene theory and practice in simple practical language which can be understood by community workers with relatively little infection control background [20].

Responding to the changing hygiene climate

The recent 'ECDC report on the state of infectious diseases' concluded that, although EU countries are generally doing well in the fight against infectious diseases, there is no room for complacency particularly in areas such as HCAs, antibiotic resistant bacteria and the threat posed by influenza and pneumococcal infections [21]. Although international, regional and national authorities are now recognising that infectious disease prevention must be a responsibility which is shared by the family and community, and are beginning to invest in programmes to develop and promote hygiene, IFH believes that, if these programmes are to be successful in achieving behaviour change, a number of issues need to be addressed:

The need for a family-centred approach to hygiene

Across Europe, public health is currently structured such that the separate aspects of hygiene – food hygiene, personal hygiene, handwashing, pandemic flu preparedness, patient empowerment etc - are dealt with by separate agencies. This means that the information which the family receives is fragmented and largely rule-based. If things are to change we must recognise that fragmented, rule-based knowledge is not enough to meet the challenges we currently face. Hand hygiene, for example is a central component of all hygiene issues and it is only by adopting a holistic approach that the causal link between hands and infection transmission in the home can be properly addressed. There is a need for the various agencies to work in partnership in order to promote an approach to hygiene which is family-centred rather than issue-oriented. At the very least we need to ensure that the principles of infectious disease transmission and the role of hygiene are part of the school curriculum. In line with this the EU-funded e-Bug project is working to roll out education on antibiotic resistance and hygiene at primary and secondary school level across Europe [22]. In order to ensure continuity of information, we also need to work more closely with the private sector that invests considerably in communicating with consumers about hygiene and hygiene products.

Although we are seeing increasing emphasis on patient empowerment as part of strategy to reduce HCAs, the evidence suggests that 'patient' empowerment is not enough, the need is for family empowerment. In response to the need for education on respiratory hygiene, ECDC has produced an 'Influenza Communication Toolkit' [23] for use by health communicators in devising campaigns to tackle seasonal influenza. In November 2007, the UK launched a winter communications campaign to encourage the public to practise correct respiratory and hand hygiene when coughing and sneezing [24].

The need to engage the family and change attitudes

In recent years hygiene has had a somewhat negative image and has come to be seen as old-fashioned and disciplinarian. We need to make hygiene more appealing to the public by realigning it with positive attributes of health and well-being. Persuading the public of the need to share responsibility without being accused of shifting blame may however be a significant challenge

The need for a risk-based approach to home hygiene

In the healthcare system, disease reduction is considered as the gold standard for assessing the effectiveness of clinical interventions. By contrast, in the industrial field, it is accepted that the cost-effective means to achieve quality (absence of microbial contamination) in products is by a risk management approach which ensures that critical control points within the process are 'under control'. Currently, there is a tendency to demand that data from intervention studies should take precedence over data from approaches such as risk assessment. Although there are those who still adhere to this, it is increasingly accepted that infection control policies and guidelines must be based on the totality of evidence including microbiological and other data, since transmission of pathogens is highly complex, involving many different pathogens, each with multiple routes of spread. This is particularly important for home hygiene, where little or no intervention data is available and the size and thus cost of intervention studies is prohibitive.

The need to balance risks against benefits of hygiene

In recent years, increasing attention has been given by the media to risks associated with hygiene. These include the perceived risk

of being too clean, concerns about toxic and environmental effects of cleaning and disinfectant products, and the possibility of links between disinfectant use and antibiotic resistance.

Media coverage of the hygiene hypothesis has declined, but a strong 'collective mindset' has become established that dirt is 'good' and hygiene somehow 'unnatural'. Although there is good evidence that microbial exposure in early childhood can protect against allergies, there is no evidence that we need exposure to harmful microbes or that we need to suffer a clinical infection [25,26]. Nor is there evidence that hygiene measures such as handwashing, food hygiene etc. are linked to increased susceptibility to atopic disease [25]. A consensus is now developing among experts that the answer lies in more fundamental changes in lifestyle that have led to decreased exposure to certain microbial or other species, such as helminths, that are important for development of immuno-regulatory mechanisms [27]. There is still much uncertainty as to which lifestyle factors are involved. There is also no evidence to suggest, as is often stated in the media, that we need to get regular infections to boost our general immunity to infection. Another key question is whether use of disinfectants is encouraging the emergence of so-called 'superbugs'. Although laboratory experiments demonstrate links between exposure to biocides and increased resistance to antimicrobials, there is currently no evidence that use of biocides in the community is linked to emergence and spread of antibiotic resistance [28].

It is vital that we continue to research these issues, but it is important to avoid overemphasising them at the expense of ensuring that the public understand the risks of not carrying out hygiene measures properly.

Conclusions

Infectious diseases circulating in the home and community are a continuing and significant burden on the health and prosperity of the European community, which could be significantly reduced by better standards of hygiene. It is now apparent that controlling infection needs to be addressed, not just in healthcare settings or in association with food hygiene, but across the community. If efforts to promote hygiene at community level are to be successful in changing behaviour, we need a concerted family-centred approach to ensure that a basic understanding of infectious disease agents and their mechanisms of spread, together with an understanding of a risk-based approach to hygiene are promoted, as part of the school curriculum and as part of public health campaigns. Alongside this, we also need unambiguous communication with the public on issues such as the hygiene hypothesis and environmental issues.

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