

RECOMMENDATIONS
FOR SELECTION OF
SUITABLE HYGIENE
PROCEDURES
FOR USE IN THE
DOMESTIC ENVIRONMENT

THIS CONSENSUS DOCUMENT BY
THE SCIENTIFIC ADVISORY BOARD
OF THE IFH IS A SUPPLEMENT
TO THE "GUIDELINES FOR PREVENTION
OF INFECTION AND CROSS INFECTION
IN THE DOMESTIC ENVIRONMENT"

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I. INTRODUCTION

The home environment, in ways that set it significantly apart from the clinical setting, is an integral part of the broader community. Within the home can be found healthcare situations, issues relating to food safety, and frequently the added factor of domestic pets. These, together with constant links with the outside world through people coming and going, are in addition to the day to day family health issues. The multifaceted nature of the domestic environment has important infection control implications for all members of a family. Societal trends in recent decades now dictate a need to re-evaluate traditional practices of infection control strategies developed by earlier generations and develop a relevant and effective strategy appropriate for infection control in the modern home setting. This work has been facilitated by the growing database of evidence derived from studies relating specifically to the home setting.

For the developing world, where infectious disease is still a primary concern, the need for improved hygiene standards is considered paramount. Although water and sanitation programmes have had a significant impact on disease, there are strong indications that, where these programmes have been undertaken in isolation without including hygiene training within the home and its immediate surroundings as an integral part, the health benefits are not commensurate with the investment made (Nath 2000, IFH Newsletter, June 2000).

In "The need for a home hygiene policy and guidelines on home hygiene" (Beumer *et al.* 1999) the International Scientific Forum on Home Hygiene (IFH) reviewed the many changes continuously occurring within modern society that significantly alter the challenges we face in preventing infectious disease in "out of hospital" settings. These changes have also been reviewed by Sattar *et al.* (1999). His assessments, seen from a North American perspective, are summarised in Appendix I.

Demographic changes now mean that family members with reduced immunity to infection, such as the elderly and those with chronic and degenerative illness, constitute an increasing proportion of the home population. It is estimated that by 2025 there will be over 800 million people world-wide over 65 years old (Anon 1998a). Other "at risk" groups which may be present in the home include neonates, immune-compromised patients discharged from hospital and patients taking immuno-suppressive drugs or

using invasive/inhalation systems. All of these groups, together with carriers of Human Immunodeficiency Virus (HIV) or Methicillin Resistant *Staphylococcus aureus* (MRSA), are increasingly cared for by home carers who may be required to perform tasks which carry a significant infection risk and thus require a good basic understanding of hygiene. Other concerns include changing infectious disease patterns, escalating treatment costs and the problem of antibiotic resistance, all of which serve to highlight the need for better infection prevention through hygiene.

Even in areas of the world where good quality food, water and sanitation is the accepted norm, infectious intestinal disease remains a significant problem with much of this disease relating to poor hygiene practice in the domestic setting. Some of the changing practices of domestic food handling and preparation (microwaving, cook-chill processes, etc) and a whole range of other technologies (air conditioning, showers, etc) are also now being shown to have implications for infection transmission. Globalisation of food supplies, travel and refugee movements all serve to move pathogens around an increasingly small world to areas where there may be little or no innate resistance. Although many of the respiratory and gastrointestinal infections that arise in the home are non-serious and self-limiting, in the developed world they still represent a significant economic burden. For "at risk" groups such infection may be much more serious and may require hospitalisation with attendant costs.

All of these factors serve as a reminder that infectious disease prevention is no less important than it ever was, and that it is only through a commitment to shared responsibility by government and the public, through the implementation of water, sanitation and other programmes, integrated with public responsibility for good hygiene practice, that the suffering associated with infectious disease and the financial burden which it represents can be contained in a manner which is sustainable.

2. RECOMMENDATIONS FOR SELECTING HYGIENE PROCEDURES IN THE DOMESTIC ENVIRONMENT

The ongoing changes outlined above, together with an awareness of changing roles within families, have prompted the IFH to formulate an approach to hygiene specifically designed for the modern domestic setting with the aim of reducing the risks of cross contamination. The drafting of "Guidelines for Prevention of Infection and Cross Infection in the Domestic Environment" accomplished a first step in this process by creating a document giving detailed consideration for each site in the home, together with basic principles for hygiene procedures to be adopted where a need for hygienic intervention is identified to prevent cross contamination. The purpose of the current document is to give more detailed recommendations on hygiene procedures for use in the home.

Both these sets of guidelines were prepared applying a risk assessment/risk prevention approach. This demands that the infection risk for each site or surface is assessed, based not only on the probability of potentially harmful organisms occurring in that particular situation, but also, and possibly more importantly, on the risk of transfer and human exposure to pathogens in a manner likely to cause infection. In both documents the environmental sites and surfaces within the home are categorised in the same manner, as shown in Table I. Additional sections on hand hygiene, air hygiene and water hygiene are also included in this document.

Readers should note that this paper refers only to the application of hygiene procedures to prevent cross contamination and cross infection in the domestic setting. It does not apply to the use of skin products (hand soaps or body washes) to reduce resident skin carriage of potential pathogens or to achieve "antiseptis" i.e., prevention of self-infection from organisms present on the body surface.

The IFH recognise that any advice given will need constant review, as new scientific evidence relating to the home becomes available. Due to the relative lack of scientific data and the consequent difficulties in reaching a consensus expert opinion, the advice in this document is given as a set of "recommendations" supported where possible by the appropriate risk/benefit information. The evidence base used in the formulation of these recommendations is given in a separate IFH document, which is in preparation (Hygiene procedures in the home and their effectiveness).

TABLE I. ENVIRONMENTAL SITES AND SURFACES WITHIN THE HOME

CATEGORY	TYPE OF SITE
RESERVOIRS	Wet sites: Toilet bowls, all sink U-tubes, plastic washing bowls, draining boards, nappy buckets.
RESERVOIR/DISSEMINATORS	Wet-cleaning utensils: dishcloths, dish sponges, floor cloths, mops, washing-up brushes, scouring pads. Bathroom objects: face cloths, bath sponges and cloths, nail brushes, toothbrushes. Showerheads, humidifiers.
CONTACT SURFACES	Hand-contact surfaces: Toilet flush handles, toilet seats, door handles, tap handles, basin and bath surfaces. Other household objects which are frequently touched by more than one person such as telephones. Hand- and food contact-surfaces: Chopping/cutting boards, kitchen work surfaces, fridge and freezer surface, cooking hob, eating and cooking utensils, baby feeding materials. Objects handled by children such as toys.
LAUNDRY	All clothing, bed-linen, towels and other linens.
OTHER SURFACES	All floors (carpeted and non-carpeted) walls, other bedroom and living surfaces, furniture, etc.

2. RECOMMENDATIONS FOR SELECTING HYGIENE PROCEDURES IN THE DOMESTIC ENVIRONMENT

The approach to home hygiene formulated by the IFH is consistent with the HACCP (Hazard Analysis Critical Control Point) approach of risk identification and risk prevention widely used in food and pharmaceutical manufacturing environments. This approach is also now being adopted in hospital settings where continued concerns about nosocomial infection rates and changing infectious disease priorities are once again forcing the need to re-evaluate strategies and place greater emphasis on infection prevention rather than control of outbreaks. In hospitals

it is recognised that the shift in emphasis from Gram-negative back to Gram-positive agents such as MRSA, together with increasing concern about viral agents, all of which have enhanced survival characteristics in the environment, requires that a more integrated approach is adopted in which environmental hygiene as well as the hygiene of hands and, for example, patient care equipment is given due attention (Exner *et al.* 1999; Dancer 1999; Griffith *et al.* 2000).

3. FACTORS TO BE CONSIDERED IN USING THESE RECOMMENDATIONS

In formulating this document the IFH considered a number of factors that have a direct and specific bearing on infection transmission in the home situation and should be taken into account in using the recommendations:

COMPLIANCE WITH HYGIENE ADVICE IN THE HOME

In making hygiene recommendations, it should be considered that the domestic environment is very different from hospital and food manufacturing environments in many respects. Although infection risks in the home are generally less than in environments such as hospitals, hygiene knowledge and understanding, and the quality of the facilities available in the home is often much lower. Whereas in institutional and other environments, implementation of hygiene procedures is regulated and sanctions can be implemented for non-compliance this is not the case in the home.

Evidence from home-based studies (as will be described in an accompanying literature review) has established that cleaning and disinfection to achieve hygiene carries a higher margin of safety when compared to a process of “cleaning” alone which may be unreliable in unskilled/casual hands in the domestic setting. Although this may involve a very small risk for “less critical” sites (e.g., eating utensils where contamination levels may be low and items are stored dry), there are some situations where the failure to achieve hygiene carries a much higher risk of serious consequences. Thus it may be that the use of a cleaning and disinfection procedure which gives a higher margin of safety may be considered in some situations in the home where cleaning alone might be considered sufficient in hospital or manufacturing settings. The IFH recognise, of course, that the efficacy of disinfection procedures as well as cleaning procedures can be compromised if the disinfectant product is not used at the correct dilution and in the correct manner.

The IFH also acknowledge that, while a recommendation to clean and disinfect a surface in a certain situation can serve to reinforce awareness of the importance of hygiene in that situation, there may also be concern that this could encourage complacency based on an assumption that the disinfectant product provides an alternative to cleaning, and lead to a decline in hygiene standards.

For these reasons, the IFH believe that in recommending a suitable hygiene procedure for a particular situation, the final decision should be made on the basis of local considerations which relate to the particular community or the individual home.

HOW SAFE IS SAFE ENOUGH?

Another factor which makes it impossible to specify precise “rules” for appropriate hygiene procedures for any given situation is the impossibility of determining what level of microbial contamination is “safe” and what represents a hazard. Although data regarding the “infectious dose” for different pathogens exists, it is known that this dose can vary widely according to the properties (pathogenicity/virulence) of the pathogen, the health and immune status of the recipient and other parameters. For this reason it is impossible to be precise about what represents the appropriate “hygienic status” for any area in any particular situation. Where vulnerable or “at risk” groups are present in the home who may be at risk from opportunist pathogens and for whom the “infectious dose” may be less than for healthy family members this becomes increasingly complex. The question of how safe is safe enough becomes a real concern where family members care for vulnerable individuals as it demands a flexible response on the part of the person applying the hygiene procedure. A significant level of understanding of the basic principles of risk and risk management through hygiene is thus required.

The need for a flexible response further reinforces the belief that, in recommending suitable hygiene procedures, the final decision should be made on the basis of local considerations relating to the particular community and/or the individual home and the person responsible for giving the care.

3. FACTORS TO BE
CONSIDERED IN
USING THESE
RECOMMENDATIONS

HYGIENE AND IMMUNITY

Recently concerns have been expressed that exposure to low levels of micro-organisms are important in maintaining our immune system against infection. A hypothesis has also been proposed which suggests that reduced exposure to microbes may be a factor in the increased incidence of allergic disease, although currently there is no proof that this is the case (Rook and Stanford 1998).

The risk identification/risk prevention approach adopted in the IFH Guidelines for home hygiene identified sites and surfaces representing greatest risk of facilitating exposure to pathogens. It is recommended that hygiene procedures be targeted at these sites. The IFH believes that this is the logical approach to improve protection against infectious disease while avoiding any possible unwelcome effects. By targeting hygiene procedures selectively and ensuring that, as far as possible, the level of "hygiene assurance" (i.e., the level of residual contamination after application of the hygiene procedure) is commensurate with the level of risk associated with exposure, the risks of infection can be reduced whilst some exposure to microbes (including harmful microbes) is maintained to encourage a "healthy" immune system.

CONCERNS ABOUT ANTIMICROBIAL RESISTANCE

Although the primary causes of antibiotic resistance are well accepted (namely antibiotic overuse in clinical and veterinary practice) laboratory studies that show links between the mechanisms whereby microbes develop reduced susceptibility to biocides and antibiotics give cause for concern. Although there is currently no evidence that biocide usage is a contributory factor in the development of antibiotic resistance, or is the cause of resistance to disinfectants and antiseptics used in hospitals or elsewhere, the debate is ongoing and will continue as new data emerges. In recommending the use of biocides in a targeted manner as part of a risk identification/risk prevention strategy, the IFH believe this approach will improve protection against infectious disease while avoiding any possible unwelcome effects.

In view of the above concerns the IFH have reviewed the subject of biocide usage and antimicrobial resistance with particular reference to the domestic setting. A detailed review and the consensus opinion can be found on the IFH website (www.ifh-homehygiene.org). Among other considerations, the consensus view of the IFH states that it is important to ensure that biocides are used responsibly as part of a good hygiene routine in the domestic setting in order to avoid the possibility of any impact on antimicrobial resistance in the future.

4. DEFINITIONS

Although the state of being free from viable organisms is defined by the term “sterile”, there is no accepted term which describes a state in which surfaces are not just visibly clean (i.e., free from visible dirt) but where microbial contamination has been reduced a level that, whilst not being sterile, is microbiologically safe for its intended use. Although it is recognised that the term hygiene has much wider connotations, for the purposes of this document the word has been adopted to describe such a state. Thus in this document the definitions presented below apply. To avoid misunderstandings it is recommended that these definitions are read before the rest of the document.

HYGIENE: A procedure or system of procedures or activities used to reduce microbial contamination on environmental sites and surfaces in order to prevent the transmission of infectious disease.

A HYGIENE PROCEDURE: A procedure that is applied to reduce the number of viable organisms to a level that is considered safe for its intended use. This may be achieved by a process of removal of the microbes, or by inactivation in situ using heat or a disinfectant. A combination of both processes may also be used.

A HYGIENIC SURFACE: A surface on which the number of microbes has been reduced to a level considered microbiologically safe for its intended use.

CLEANING: A physical process or product that removes soil or organic material from an object or surface, but does not have bactericidal, sporicidal, virucidal, fungicidal activity and does not necessarily reduce the level of microbial contamination.

DISINFECTANT CLEANER: A product that removes soil or organic material from an object or surface and also causes destruction of micro-organisms through an inherent bactericidal, virucidal or fungicidal activity: the combination of soil removal and destruction reduces contamination to a level where there is no longer a threat to health by transmission of the micro-organisms.

HYGIENIC HANDRUB: A postcontamination procedure that involves rubbing hands without the addition of water, using a bactericidal preparation directed against transient micro-organisms to prevent their transmission regardless of the resident skin flora. The product should comply with European Standard EN 1500, “Chemical disinfectants and antiseptics – hygienic handrub – Test method and requirements (phase2/step2)”. This requires that when tested in accordance with the standard the mean reduction in the

release of test organisms following a 1 minute contact period should not be significantly smaller than that achieved by the reference handrub containing 60% v/v propan-2-ol.

HYGIENIC HANDWASH: A post-contamination procedure that involves washing hands using a bactericidal product directed against transient micro-organisms to prevent their transmission regardless of the resident skin flora. The product should comply with European Standard EN 1499, “Chemical disinfectants and antiseptics – hygienic handwash – Test method and requirements (phase2/step2)”. This requires that when tested in accordance with the standard the mean reduction in the release of test organisms following a 1 minute wash period should be significantly greater than that achieved by the reference handwash with unmedicated liquid soap.

DISINFECTANT (BRITISH STANDARD 5238): A chemical agent that under defined conditions is capable of the destruction of micro-organisms, but not usually bacterial spores: it does not necessarily kill all micro-organisms, but reduces them to a level acceptable for a defined purpose, for example a level which is harmful neither to health nor to the quality of perishable goods.

BACTERICIDE (BS 5283): A chemical agent that under defined conditions is capable of killing bacteria, but not necessarily bacterial spores.

FUNGICIDE (BS 5283): A chemical agent that under defined conditions is capable of killing fungi.

SPORICIDE (BS 5283): A chemical agent that under defined conditions is capable of killing bacterial spores.

VIRUCIDE (BS 5283): A chemical agent that under defined conditions is capable of killing or inactivating viruses.

ANTIBACTERIAL: This term has no quantitative meaning and is commonly used to describe a product or process that kills bacteria or inhibits their growth.

STERILE (EN 556): The state of being free from viable organisms. Note: the theoretical probability of there being a viable organism present should be less than or equal to 1×10^6 .

MPN: Most probable number: an estimate of the number of viable bacteria in unit volume as determined using a tube dilution method (Anon 1990b).

NTU: Nephelometric Turbidity Unit: an estimate of the turbidity of a water sample (Anon 1989).

5. IFH CONSENSUS STATEMENTS ON HYGIENE PROCEDURES

The following represents a summary of the consensus opinion of the IFH board on the procedures for managing situations in the domestic setting where a risk of cross contamination and cross infection exists or occurs. Detailed guidelines for each of the categories set out below can be found in the equivalent subsection of section 6.

5.1 IFH CONSENSUS ON HANDS

- The importance of good hand hygiene in the home cannot be overemphasised.
- Based on current evidence, it is considered that in the majority of general household situations thorough handwashing with soap and water, following the prescribed routine, is sufficient to reduce the risks of infection transmission.
- It is stressed, however, that to be effective handwashing must include rinsing with sufficient good quality (i.e. potable) running water and thorough drying.
- Where good quality running water is not available, and/or unavailable in sufficient quantity, the use of an alcohol handrub or handwipe is recommended, if possible, after defecation or handling raw and potentially contaminated food.
- Promotion of hand hygiene must also be combined with education in good hand washing practice to be effective. Such programmes should also aim to raise awareness of the key role of the hands in transfer of infection.
- In situations where there is significant risk of cross contamination involving pathogens (e.g., presence of an infected person or pets, or handling contaminated foods) or where there are family members with increased susceptibility to infection, the added use of a hygienic handrub, handwipe or handwash provides an important added safety margin to the normal washing procedure.
- It must be borne in mind that although some hygienic handrub and handwash products may have activity against both bacteria and enveloped viruses, activity against non-enveloped viruses is generally limited.

5.2 IFH CONSENSUS ON HAND- AND FOOD-CONTACT SURFACES

- Based on current evidence, it is considered that the hygiene of hand-, food- and drinking water- contact surfaces, particularly those in the kitchen, bathroom and toilet, is a key component in reducing the transmission of infectious disease in the home.
- Since the infection transfer risks from these surfaces can vary considerably from one situation to another, the IFH advocate that the individual responsible for giving advice must decide on the appropriate hygiene procedures to be recommended, based on risk-benefit considerations.
- It is considered that where rinsing with ample running, potable and, preferably, hot water is possible, hygiene of these surfaces can be achieved by thorough cleaning with soap or detergent, followed by rinsing and drying.
- Where thorough rinsing of surfaces with safe water is not possible, the use of an effective disinfectant at the correct dose and for the correct contact period is considered to give an important extra margin of safety.
- Use of a disinfectant in addition to (or in conjunction with) cleaning in order to give a higher margin of safety may also be advisable in situations where failure to achieve hygiene with soap and water is a real possibility and/or carries a higher risk of serious consequences. This may include both general situations (for example, in developing countries where standards of hygiene and cleanliness may be generally lower) as well as specific risk situations (for example the presence of an infected or vulnerable person in the home).
- Decisions on where and when to use a disinfectant should take into account local conditions within the community and, if necessary, within the individual home.
- There are firm arguments in favour of applying disinfectants where the potential for infection is high, but there are also arguments not to do so, such as concerns about the misuse of biocidal agents.
- The IFH stress that recommendations concerning hygiene procedures for hand- and food-contact surfaces must be integrated with advice on good food handling and other hygiene practices in the home.

5.3 IFH CONSENSUS ON RESERVOIR DISSEMINATORS

- Based on current evidence, it is considered that the hygiene of reservoir sites such as cleaning cloths, humidifiers, showerheads and nebulisers, which have a high potential for disseminating micro-organisms, is an important component of home hygiene.
- In particular, it is considered that maintaining the hygiene of cleaning utensils, especially those that are used wet, is one of the most important aspects of hygiene in the home and requires specific attention.
- It is considered that in every case, items designated as reservoir disseminators should be made hygienic with a process that combines soil removal with a process which will inactivate micro-organisms (heat and/or chemical disinfection).
- For cleaning utensils, hygiene should be achieved by cleaning with detergent and hot water followed by treatment at high temperatures or the application of a disinfectant, followed by thorough drying.
- It is important that the public is made aware of the cross contamination risk associated with cleaning utensils and other reservoir disseminators, and their central role in hygiene practice.

5.4 IFH CONSENSUS ON RESERVOIRS

- The IFH consider that although the toilet, the sink, basin and bath U-tubes and overflows, and household drains have the potential (either intermittently or permanently) to harbour reservoirs of pathogenic microbes, unless there is vomiting or diarrhoeal disease within the family, these represent a relatively low infection risk since the risks of transfer from these sites are relatively low.
- Toilet flushing is considered sufficient to remove most of the microbial contamination from the toilet bowl and the surface of the bowl, provided that an adequate amount of water (minimum 15-17 litres of water) is used for flushing.
- Toilet flushing does not however achieve decontamination under the flushing rim of the toilet. Thus it is considered that the toilet requires regular application of a hygiene procedure which will maintain a low level of contamination in the toilet bowl and under the flushing rim to prevent build up of biofilms or scale that could harbour pathogens.

- Disinfection of sites such as sink and basin U-tubes, sink overflows and drains is considered as the appropriate means to prevent the build up of microbial biofilms at these sites.
- In situations where an infected person is known to be, or have been, present or where there is a high incidence of diarrhoeal disease, regular disinfection of the toilet is advised.
- Disinfection of sinks and sink U-tubes and overflows as well as toilets is recommended in homes where there is a person who is particularly vulnerable to infection. Toilet blocks may be useful in protecting such groups by continuously maintaining only a low level of contamination in the toilet.

5.5 IFH CONSENSUS ON LAUNDRY

- The IFH consider that soiled clothing and linens can be a source of cross infection in the domestic setting if not properly handled.
- Hands should always be washed after handling soiled laundry.
- All soiled clothing and household linens that routinely carry a risk of contamination with faecal, skin-borne or other pathogens should be laundered at 60°C, or at 40-60°C using an activated bleach-containing powder.
- It is important to ensure that polluted water is not used for laundry purposes, particularly where laundry is carried out outside the home.
- It is important that laundry is dried immediately after the washing process is completed.
- At least once a week a high temperature wash or chemical disinfectant should be used to prevent the build up of biofilms within the washing machine.
- Washing at temperatures of 40°C or below using a non-bleach detergent may not provide effective decontamination.
- Where clothing is heavily soiled and is likely to be contaminated with pathogens, or where people who are particularly vulnerable to infection are present in the home, it is recommended that all clothing and linens should be laundered at 90°C or at 60°C using an activated bleach-containing powder.
- In all situations, clothing items, linens and cloths which carry a risk of faecal or other pathogenic contamination should be segregated from items such as cleaning cloths and tea towels that are used during food preparation.

5.6 IFH CONSENSUS ON FLOORS, WALLS AND FURNISHINGS

- For the most part the risks of exposure to pathogens as a result of microbial contamination on floors, walls and furnishings are considered very low.
- In most situations, cleaning with detergent and water is considered adequate for floors, walls and furnishings.
- It is recommended that properly maintained, fitted carpet should be vacuumed thoroughly at regular intervals to lower the level of particulates and dust mites.
- Spillages of infectious material should be removed by cleaning followed by disinfection.
- If a fitted carpet cannot be properly maintained it is considered a potential health risk and should not be the floor covering of choice, particularly in families where there are small children who are not yet walking, or other groups with a higher infection risk or allergy.
- For tiled walls or other areas where moisture may collect, cleaning with disinfection is advised in order to prevent the build up of fungal contamination.

5.7 IFH CONSENSUS ON WATER QUALITY

- Water quality is of prime importance because of its central role in the practice of home hygiene. Where good quality (i.e., potable) water is not available, boiling or other methods should be applied to produce safe water.
- Where water must be stored in the home, conditions of handling and storage are of extreme importance. Water storage vessels should be thoroughly cleaned before refilling by rinsing with good quality (i.e., potable) water. They should also be disinfected periodically. Hand contact with stored water for drinking or for hygienic cleaning must be avoided.

5.8 IFH CONSENSUS ON INDOOR AIR QUALITY

- Optimum air quality should be maintained by good ventilation of the home.
- Prevention of dust and surface contamination is a key factor in determining air quality.
- Humidity control is a factor in controlling the growth of mould, which in turn plays a role in determining air quality.
- Where members of the family are known to be atopic, particular attention should be given to air quality.

6. RECOMMENDATIONS FOR HYGIENE PROCEDURES

6.1 HANDS

It is difficult to over-stress the importance of good hand hygiene. The IFH recommend that this issue should be given priority as part of early health education as it is recognised to be more difficult to instigate changes in hygiene habits in adulthood. Reports from WHO and UNICEF suggest that sanitation and water-related disease in the developing world could be reduced by up to 60% if compliance with handwashing after defecation could be achieved (Marieke et al. 1993).

Hand hygiene practice should be applied to reduce the transfer of infectious agents from a person's hands to their mouth, nasal mucosa or conjunctiva. It should also be applied to avoid spreading infectious agents (including opportunist pathogens which may be commensal to that person) to other people, either directly or via other surfaces and/or food in the home. This is particularly important in the case of identified carriers of certain infectious agents and when caring for a person in the home who is particularly vulnerable to infection. Thus, handwashing should be carried out whenever there is significant chance that the hands have been in contact with other people, domestic animals, food and surfaces or objects that are likely to be contaminated with pathogens. Hand hygiene should always be practised after toilet visits and nappy changing, before and during preparation of food, and before eating food.

Hand hygiene in relation to water quality is further discussed in the section on water hygiene.

IFH CONSENSUS ON HANDS

- The importance of good hand hygiene in the home cannot be overemphasised.
- Based on current evidence, it is considered that in the majority of general household situations thorough handwashing with soap and water, following the prescribed routine, is sufficient to reduce the risks of infection transmission.
- It is stressed, however, that to be effective handwashing must include rinsing with sufficient good quality (i.e. potable) running water and thorough drying.
- Where good quality running water is not available, and/or unavailable in sufficient quantity, the use of an alcohol handrub or handwipe is recommended, if possible, after defecation or handling raw and potentially contaminated food.
- Promotion of hand hygiene must also be combined with education in good hand washing practice to be effective. Such programmes should also aim to raise awareness of the key role of the hands in transfer of infection.
- In situations where there is significant risk of cross contamination involving pathogens (e.g., presence of an infected person or pets, or handling contaminated foods) or where there are family members with increased susceptibility to infection, the added use of a hygienic handrub, handwipe or handwash provides an important added safety margin to the normal washing procedure.
- It must be borne in mind that although some hygienic handrub and handwash products may have activity against both bacteria and enveloped viruses, activity against non-enveloped viruses is generally limited.

There are three alternative methods of achieving hand hygiene:

- **Hand washing using soap or a detergent and running water.** Hand hygiene is achieved by removal of microbes from the hands. The soap or detergent aids in the removal of soil and micro-organisms. Soap may also have some bactericidal effect. It must be remembered that pathogens removed from the hands by this method may contaminate the surfaces of the washbasin, basin U-bend and the water used for rinsing the hands.
- **Use of a hygienic handrub.** Hygiene handrubs are products which incorporate alcohol (ethanol, n-propanol or isopropanol) at a concentration between 60% and 90% v/v, either alone or combined with an agent such as chlorhexidine (0.5% w/v). These products should preferably be used after soiling has been removed by hand washing with soap/detergent and water. Hand hygiene results from the inactivation of microbes on the skin surface. Use of a hygienic handrub is recommended where the water is not of adequate quality and/or is not accessible or freely accessible for rinsing the hands. Hygienic handrubs are also useful in emergency situations where rapid hand decontamination is required, provided that the hands are not heavily soiled. The product may be applied directly to the hands or by the use of an impregnated handwipe (Jones *et al.* 1986). The problem of skin dryness and irritancy that can reduce compliance with use of these products for hand hygiene can now be resolved by the availability of alcoholic handrubs containing emollient agents. Products used as a hygienic handrub should comply with the European test for Hygienic Handrubs EN 1500 (Anon 1997a).
- **Handwashing using a hygienic handwash product.** A hygienic handwash is a blend of soap and an antibacterial agent such as chlorhexidine (4% w/v). Hand disinfection is achieved by the combined effects of removal and bacterial kill. Products that are used as a hygienic handwash should comply with the European test for Hygienic Handwash EN 1499 (Anon 1997b).

Note: Prevention of viral transmission

In the domestic environment, the transfer of enteric and respiratory viruses is a particular concern (Sattar and Springthorpe 1996; Barker, Stevens and Bloomfield 2000, in press). Although the range of handrub and handwash products outlined above have good activity against bacterial pathogens, activity against viral contamination is variable and depends on the type of virus. Experimental evidence suggests that although alcoholic handrubs may be effective against enveloped viruses such as influenza, parainfluenza, HIV, herpes and respiratory syncytial virus, activity against non-enveloped viruses such as rotaviruses, rhinovirus, poliovirus, adenovirus, small round structured virus and hepatitis virus is limited unless extended contact times (up to 10 minutes) are applied. Similarly, agents such as triclosan and chlorhexidine have some activity against enveloped viruses but are not considered effective against non-enveloped viruses. Studies by Schurmann and Eggers (1985) also suggest that enteric viruses, particularly poliovirus but possibly many other enteric viruses, may be more strongly bound to the skin surface and that the inclusion of an abrasive substance in the handwash preparation such as sand or aluminium hydroxide is advisable to achieve effective virus removal from the hands.

The effectiveness of hand hygiene procedures and antimicrobial agents used in handrub and handwash products is reviewed in more detail by Sattar and Springthorpe (1996) and Rotter (1997). In making recommendations for the domestic setting official guidelines on hand hygiene in hospital and institutional settings in Germany and the US have also been taken into account (Anon 2000a, Larson 1995).

GENERAL SITUATION

The IFH recommends that in a normal, healthy household the choice of hand hygiene procedure should be based on the following considerations:

- For situations where it is possible to apply a rinsing process, it is considered that a hygienic state is achievable by cleaning using soap or detergent and hot water with a mechanical action. The IFH Guidelines provide instructions on the recommended technique for good handwashing. To be effective, handwashing must include rinsing with sufficient good quality (i.e., potable) running water and thorough drying. The quality of the water for rinsing (which, while taken for granted in developed countries, can be a problem in some areas of the world) is of prime importance, as is the method by which hands are washed. In some countries scarcity of water can be a significant deterrent to developing good hand hygiene practice. In these situations it may be possible to design simple handwashing facilities which allow the wash water to be collected for further use, e.g., irrigation.
- Hand hygiene is extremely important in the kitchen during the preparation of raw meat, poultry, shellfish and eggs that might be contaminated with typical food-borne pathogens. In this situation the use of a hygienic handrub or handwash may give an extra margin of safety in the prevention of transmission of pathogens to other foods or hand to mouth transfer.
- The use of alcoholic handrubs or handwipes is recommended for situations where a suitable source of water is not accessible or readily accessible, e.g., outdoor picnics or barbecues, travelling with young children, or during nappy changing.
- The decision whether to recommend the use of a handwash or handrub product in the domestic situation is the subject of a debate that cannot be resolved on the basis of current evidence. If the recommended procedure for handwashing with soap and water is not followed it is known that parts of the hands are missed and that the contamination removal is impaired. Bearing in mind that individuals in the home setting frequently do not follow the recommended handwashing procedure, due to lack of knowledge, pressures of time or disregard for risk, it is considered that the use of handwash or handrub products may give an increased margin of safety in situations where failure to achieve hygiene carries a greater risk of serious consequences.

SITUATIONS OF SPECIFIC RISK

Specific situations where use of a hygienic handrub or handwash in the home is considered routine best practice include:

- Where an infected individual is present in the home. If an individual is suffering from vomiting or fluid diarrhoea the bacterial or viral load on contaminated hands may be high. Where family members are infected with cold and possibly also flu virus there is evidence that transfer of viral infection frequently occurs via the hands (Eccles 2000).
- In some countries (e.g., Germany and Italy) the use of alcohol handrubs for hand hygiene is mandatory for persons known to be carriers of *Salmonella*, *Shigella* or other pathogen transmitted by the faecal oral route. The Health Department in Germany issues registered carriers with an alcoholic disinfectant to be used routinely in the home and elsewhere after toilet visits.
- Hand disinfection using an alcohol-based handrub or handwipe in addition to handwashing is recommended before carrying out healthcare procedures involving vulnerable groups, e.g., catheter care for a geriatric person in the home.

Comments

The significant benefits of handwashing in the community are supported by epidemiological data that show a reduction in faecal-oral diseases in areas where handwashing education programmes have been implemented. The above recommendations, however, are based primarily on evidence derived from laboratory-based studies or studies in hospitals or other institutions such as day-care centres, since little or no data specific to the home is available. In order to provide more specific recommendations for hand hygiene, further data that are specific to the home are required. Most urgently, there is a need to better understand how bacterial and viral agents are picked up by the hands and the extent to which they are "released" from the hands by contact with another surface or another person. There is also a need to establish the extent of handwashing compliance in the home situation and the relative health benefits of adopting the use of hand hygiene products (handwash or handrub) that give a higher margin of safety compared with handwashing alone. The impact of hand hygiene education programmes in the community also requires evaluation.

6.2 HAND-CONTACT AND FOOD-CONTACT SURFACES

Hand-contact and food-contact surfaces in the home can become contaminated with a range of microbial pathogens and can act as a potential source for the transfer of these pathogens to hands or food. It is known that, even for healthy family members, the infectious dose for some enteric and respiratory pathogens, particularly viruses, can be very small (10-100 viable units or even lower for some viruses) and that infection can result from direct transfer from surfaces via the hands or food to, for example, the mouth, nasal mucosa and conjunctiva. Although the infectious dose for bacterial enteric pathogens is generally higher (up to 10^6 viable units), in certain situations it may be relatively low (<100 cfu). For organisms such as *Salmonella* even very low numbers of organisms can grow to high numbers in very few hours at room temperature if transferred to other foods.

Pathogenic organisms are introduced continuously into the home via an infected source such as contaminated water or raw food, an infected person or pets, and sometimes also insects and other pests. Clearly, contamination of hand- and food-contact surfaces should be avoided as far as possible, e.g., raw meat or poultry should not be placed directly onto kitchen surfaces or into the refrigerator, and pets should be kept away from such surfaces. In many situations, however, actual or potential contamination of these surfaces is unavoidable, in which case they should be treated by the application of a suitable hygiene procedure.

In areas where there is a need to store water in the home for extended periods it is vital to ensure that vessels in contact with water are cleaned thoroughly with high quality (i.e., potable) water each time before refilling and decontaminated regularly in order to ensure that pathogenic microbes in the residual water in the container do not recontaminate subsequent batches. These items are further discussed in the section on water quality.

IFH CONSENSUS ON HAND- AND FOOD-CONTACT SURFACES

- Based on current evidence, it is considered that the hygiene of hand-, food- and drinking water-contact surfaces, particularly those in the kitchen, bathroom and toilet, is a key component in reducing the transmission of infectious disease in the home.
- Since the infection transfer risks from these surfaces can vary considerably from one situation to another, the IFH advocate that the individual responsible for giving advice must decide on the appropriate hygiene procedures to be recommended, based on risk-benefit considerations.
- It is considered that where rinsing with ample running, potable and, preferably, hot water is possible, hygiene of these surfaces can be achieved by thorough cleaning with soap or detergent, followed by rinsing and drying.
- Where thorough rinsing of surfaces with safe water is not possible, the use of an effective disinfectant at the correct dose and for the correct contact period is considered to give an important extra margin of safety.
- Use of a disinfectant in addition to (or in conjunction with) cleaning in order to give a higher margin of safety may also be advisable in situations where failure to achieve hygiene with soap and water is a real possibility and/or carries a higher risk of serious consequences. This may include both general situations (for example, in developing countries where standards of hygiene and cleanliness may be generally lower) as well as specific risk situations (for example the presence of an infected or vulnerable person in the home).
- Decisions on where and when to use a disinfectant should take into account local conditions within the community and, if necessary, within the individual home.
- There are firm arguments in favour of applying disinfectants where the potential for infection is high, but there are also arguments not to do so, such as concerns about the misuse of biocidal agents.
- The IFH stress that recommendations concerning hygiene procedures for hand and food contact surfaces must be integrated with advice on good food handling and other hygiene practices in the home.

There are 3 alternative procedures for achieving hygiene of hand- and food-contact surfaces:

- Cleaning using detergent (liquid or soap) and hot water. Detergent and hot water cleaning is considered sufficient to produce a hygienically clean surface provided that the critical rinsing step is adequately performed. The practical ability to rinse a surface free of microbes with running, good quality (i.e., potable) and, preferably, hot water is central to achieving hygiene with detergent and water.

Where cleaning is used as the means to achieve a hygienic surface the detergent should be of good quality in order to maximise soil and bacteria removal. Cleaning may not be a reliable hygiene procedure if the surface is in poor condition, i.e., damaged or enables the persistence of moisture, residual soil and biofilms. Mechanical action using a cloth, sponge or brush to maximise removal of soil and microbes is an important part of the process. Removal of soil by wiping with a cloth without subsequent rinsing is not considered sufficient to achieve a surface that is hygienic. Use of a contaminated cloth can actually spread pathogenic organisms onto previously uncontaminated hands and hand- and food-contact surfaces. This is a particularly important consideration in relation to surfaces that have been used to prepare raw meat, poultry, etc. The hygiene of cloths and other cleaning equipment is a critical issue in the realisation of surface hygiene and is considered in detail in the following section on reservoir disseminators.

The microbial quality of the detergent is also a consideration. Although concentrated detergent formulations inhibit microbial growth and may to some extent be microbicidal, species such as *Ps. aeruginosa* can grow in detergent products diluted to less than about 20% v/v in tap water, thereby becoming a source of microbes in the home environment. Supplying, or preparing and storing dilute solutions of detergents for domestic use should be avoided.

- Cleaning using soap or detergent followed by application of a disinfectant product. When choosing a disinfectant product for achieving a hygienic surface, an agent should be selected that has rapid microbicidal action against bacterial and viral pathogens. Action against fungi may also be desirable at times. Products should be used at concentrations and under conditions that give rapid and effective inactivation of micro-organisms. In this respect, compatibility with water hardness,

effectiveness at the expected soil level and the contact time necessary for disinfection are primary considerations. For further information, published guidelines on the selection and use of disinfectant products should be consulted (Anon 1991; Anon 2000b). Antimicrobial products that claim only to “prevent growth of microbes” should be avoided.

- Cleaning and disinfection using a combined detergent and disinfectant formulation. In hospital practice and food manufacturing, it is specified that since disinfectants are inactivated to a greater or lesser extent by the presence of soil, surfaces must be cleaned before application of a disinfectant. This is particularly important for heavily soiled surfaces, e.g., food-contact surfaces. Within the home it may be considered that this is less important for surfaces such as door and tap handles where soiling is minimal. Since the time allocated to cleaning in the home is often limited and insistence on a 2-stage procedure may reduce compliance, use of a good quality, formulated disinfectant cleaner may be considered satisfactory in this situation. A recent study in a catering environment showed that the level of hygiene assurance achieved on a range of contact surfaces using a combined detergent and disinfectant (active chlorine or quaternary ammonium disinfectant) was equivalent to that obtained by a 2-stage cleaning and disinfection process (Stekelenburg and Hartog 1999).

Additionally:

Although micro-organisms cannot grow on a dry surface, and drying will lead to loss of viability, organisms can survive under dry conditions for significant periods of time. Drying should not be relied upon as a means of achieving hygiene but is a key process for maintaining surfaces in a hygienic state since organisms require moisture to multiply and preserve cell viability.

Cleaning and disinfection procedures are not intended to achieve sterility and some exposure to microbes is expected. For normal healthy children and adults this limited exposure is considered desirable.

GENERAL SITUATION

In a normal family situation the choice of hygiene procedure from those specified above should be based upon the following considerations:

- For items such as cooking and eating utensils, the use of detergent and hot water is recommended provided that there is a supply of running water and other criteria, as specified above, are satisfied. In developing countries, washing of utensils in grossly polluted water, such as polluted river water, is a major health hazard and steps should be taken to prevent this practice.
 - Kitchen chopping boards are considered to be a special case. Ideally a separate chopping board should be reserved for preparation of raw foods such as meat, fish and poultry. Although the chopping board can be made hygienic by detergent and hot water cleaning with thorough rinsing, the effectiveness of the process is likely to be compromised if the board is damaged after prolonged use. A damaged board will harbour dirt and moisture, which will encourage survival and in some cases, for example, *Salmonella*, growth is also a possibility. It is thus important that chopping boards are regularly replaced, but by virtue of their function, they are always likely to have sustained some damage, and therefore the application of cleaning and disinfection is recommended for these items. Alternatively, kitchen chopping boards may be disinfected in the dishwasher if the wash cycle is run at a temperature of 60°C or more.
 - For those hand- and food-contact surfaces in the kitchen, bathroom and toilet where effective rinsing is not possible, such as large food preparation surfaces areas in kitchens or taps and flush handles, door handles, toilet seats and nappy changing mats, the appropriate means to achieve hygiene is by cleaning and disinfection. In the kitchen, all hand-contact and food-contact surfaces should be made hygienic immediately after handling of raw foods, particularly meat, poultry and fish, and also during the cleaning up process after the meal. Prevention of cross contamination via hand-contact surfaces elsewhere in the home (particularly in the toilet) is also important, but it is recognised that maintaining such surfaces in a hygienic condition is not feasible since they are likely to be in constant use whilst the family is at home. The IFH believes that it is important to raise awareness of the potential for cross contamination via these surfaces and that disinfection as well as cleaning of these surfaces is advisable.
- The decision as to whether and where to recommend the use of disinfectants is the subject of much debate and difference of opinion, which cannot be resolved on the basis of the evidence currently available. Although concerns are raised that disinfectants may be incorrectly used in the home (i.e., at the wrong concentration for an insufficient contact time), behavioural studies show that procedural errors are as likely to occur with soap and water cleaning as with the use of a disinfectant (Scott and Bloomfield 1984; Cogan *et al.* 1999). Evidence from home-based studies show that, in practice, disinfectant usage in addition to (or in conjunction with) cleaning gives an additional margin of safety over and above that achieved by cleaning alone, by increasing the probability of achieving a satisfactory result. Although failures in hygiene practice may represent a very small risk for “less critical” sites such as eating utensils where “pre-washing up” contamination levels should be low and the items are stored dry, there are many situations in the home where the failure to achieve hygiene carries a much higher risk of serious consequences, for example, food-contact surfaces, and hand-contact surfaces following the preparation of contaminated raw food. Some experts argue that the recommendation to clean and disinfect surfaces for which the consequences of failure are most serious serves to reinforce awareness of the importance of hygiene in that situation. On the other hand there is an argument that recommending disinfectant usage could encourage complacency and an assumption that the product provides an alternative to cleaning.

The IFH consider that use of a disinfectant on hand-contact and food-contact surfaces may be advisable to give an extra margin of safety in situations where one or more of the following factors apply. This should be assessed according to local conditions:

- high local infectious disease prevalence, i.e., data from surveillance studies on rates of infectious intestinal disease in the community, the types of organisms involved and the typical infectious dose
- poor microbial quality of locally available food and water
- inadequate kitchen and bathroom facilities (e.g., layout and design of the kitchen, availability of sinks, etc.) and other factors which may influence the potential for preventing cross contamination

- poor quality of the domestic surfaces, e.g., porosity, roughness, or damage, and problems related to accessibility for cleaning/drying
- low level of knowledge and comprehension of hygiene practices within the community and family
- extensive sharing of bathroom and toilet and other facilities, including overcrowding in the home
- climatic conditions, e.g., warm climate which could increase potential for pathogen growth if transferred to cooked foods, or humidity that will encourage mould growth on surfaces

Examples:

- Recent estimates in the UK suggest that 1 in 5 of the population currently suffer infectious intestinal disease each year. The causative organisms include viruses such as SRSV that are spread not just via food but also by person to person and via the environment. It is also known that up to 75% of poultry prepared in the domestic kitchen in the UK is contaminated with either *Salmonella* or *Campylobacter*. Given that cross contamination is cited as a causative factor in up to 39% of reported outbreaks (Evans *et al.* 1998), and the fact that kitchen facilities in many homes are relatively poor, the need for cleaning and disinfection to prevent cross contamination during food handling is advisable.
- In developing countries, where standards of hygiene and cleanliness may be lower, the routine use of disinfectants in addition to or in conjunction with cleaning of hand-contact and food-contact surfaces may be advisable in order to give an extra margin of safety.

SITUATIONS OF SPECIFIC RISK

Situations within the home which require special consideration include:

- Rigorous hygiene standards that involve cleaning and disinfection for hand-contact as well as food-contact surfaces should be applied in situations where there is a known infected person present who may be shedding intestinal pathogenic organisms either as a result of vomiting or diarrhoea, especially if the person is not able to practise good hand hygiene. The same may be considered in response to other infections, e.g., during cold and possibly also flu epidemics, where recent studies suggest that rigorous surface hygiene in combination with other measures, may help reduce cross infection risks (Eccles 2000). If possible people who are ill should be prevented from preparing food in the home.
- Where there is a known infected person or a carrier of MRSA who may be shedding contaminated skin scales, rigorous hygiene standards for hand-contact as well as food-contact surface hygiene which involve cleaning and disinfection should be applied.
- Where there have been spills of potentially infectious material such as vomit, blood, other body fluids or faeces on hand- and food-contact surfaces, disinfection is recommended after cleaning.
- The same considerations apply to homes in which there is an immune-compromised family member (i.e., persons with an underlying immunodeficiency disease such as leukaemia or HIV, or who may be taking immuno-suppressant medication) for whom infections can lead to complications that are life threatening. For these individuals the infectious dose may be very small and they may be susceptible not only to primary but also to opportunist pathogens. In this situation disinfection in addition to cleaning is recommended for all hand- and food-contact surfaces to ensure that the contamination risk is reduced to a low level.

Note: If the material is considered particularly infectious, e.g., vomit associated with SRSV infection, it may then be advisable to apply disinfectant to the infected material before cleaning in order to protect the person doing the cleaning. In this situation the wearing of disposable protective gloves is also advised. Disinfectant should then be reapplied to the surface after cleaning.

6. RECOMMENDATIONS FOR HYGIENE PROCEDURES

Comments

Further research is needed to increase knowledge of the survival and transmission of pathogens around the home on hand- and food-contact surfaces. There is also a need to establish the extent of compliance with effective hygiene procedures associated with these surfaces in the home. Few studies have been published that establish the relative efficacy of cleaning compared with cleaning and disinfection, and with products combining cleaning with disinfection in the home environment. Following further studies this situation will be clearer and recommendations can be more precise. For the present, the discussions presented above allow for individual decisions to be taken based on risk assessment.

Work is also required to evaluate the extent of the hygiene benefit derived from inclusion of antibacterial agents into plastics and food laminates for food preparation and other surfaces. Originally these agents were incorporated on the grounds of protecting the plastics themselves from microbial degradation but more recently disinfection and health claims have been made for such products. The IFH are concerned that there is no published scientific data indicating any hygiene benefits associated with these products.

6.3 RESERVOIR DISSEMINATORS

Used correctly, cleaning cloths, and items such as sponges, play an important hygiene role as they aid detachment of particles from surfaces and can remove a significant proportion of the soil and microbes that are present on that surface. However, as these items frequently remain wet for long periods of time and also contain at least some residual soil, they provide ideal conditions for survival and/or growth of microbes. Cloths, particularly when used on several surfaces consecutively, can pick up contamination from one surface and redeposit it on another. By the nature of their function they thus represent a serious risk in terms of their potential to increase exposure of family members to harmful microbes that may be present, by spreading these microbes between hands and hand- and food-contact surfaces. In this respect, hygiene procedures applied to kitchen cloths have an important role in preventing the spread of microbes from dirty to clean surfaces. The same considerations also apply to facecloths, sponges, etc. Additionally items such as showerheads, humidifiers, nebulisers and air-conditioning units are also considered to be reservoir disseminators.

GENERAL SITUATION

During food preparation a hygiene procedure should be applied to cloths immediately after contact with raw food or after the cleaning of items which have been in contact with raw food. Alternatively, a fresh cloth should be used for further food preparation activities. All cloths must also be made hygienic after cleaning kitchen surfaces at the end of the meal and after all other routine or specific cleaning activities in the home. In toilet and bathroom areas, after the cleaning of toilets and toilet surfaces it is also important that a fresh cloth is used or the cloth is decontaminated before cleaning other surfaces.

IFH CONSENSUS ON RESERVOIR DISSEMINATORS

- Based on current evidence, it is considered that the hygiene of reservoir sites such as cleaning cloths, humidifiers, showerheads and nebulisers, which have a high potential for disseminating micro-organisms, is an important component of home hygiene.
- In particular, it is considered that maintaining the hygiene of cleaning utensils, especially those that are used wet, is one of the most important aspects of hygiene in the home and requires specific attention.
- It is considered that, in every case, items designated as reservoir disseminators should be made hygienic with a process that combines soil removal with a process which will inactivate micro-organisms (heat and/or chemical disinfection).
- For cleaning utensils, hygiene should be achieved by cleaning with detergent and hot water followed by treatment at high temperatures or the application of a disinfectant, followed by thorough drying.
- It is important that the public is made aware of the cross contamination risk associated with cleaning utensils and other reservoir disseminators and their central role in hygiene practice.

Cleaning cloths

As far as cleaning cloths are concerned it is considered that disposable cloths should be used wherever possible. It is particularly advisable to use disposable cloths to clear up material that is likely to be heavily contaminated with pathogens such as vomit or faeces. These cloths should be discarded immediately after use. For reusable cloths, detergent and water washing alone is not considered sufficient to achieve a hygienic state. As a routine, both in normal healthy households as well as in situations of specific risk, all non-disposable cleaning cloths and sponges should be made hygienic with one of the procedures described below.

For reusable cloths, hygiene may be achieved by any of the following procedures provided that the cloth is decontaminated regularly as described above:

- Rinsing with detergent and hot water followed by immersion in water held at 90°C or more for 2 minutes. This can be achieved by immersing the cloth in boiling water.
- Rinsing with detergent and hot water followed by a dishwasher cycle at a minimum temperature of 60°C.
- Rinsing with detergent and hot water followed by laundering. For soiled cloths, e.g., kitchen cloths used with food-contact surfaces, a laundry cycle at 60°C should be used. For other cloths laundry cycles as described in the section dealing with laundry are considered satisfactory.
- Rinsing with detergent and hot water followed by application of a disinfectant. When choosing a disinfectant product for achieving a hygienic state, an agent should be selected which has rapid microbicidal action against bacterial and viral pathogens. Products should be used at concentrations and under conditions that give rapid and effective inactivation of micro-organisms. In this respect, compatibility with water hardness, efficacy at the expected soil level and the contact time necessary for disinfection are primary considerations. For further information, published guidelines on the selection and use of disinfectant products should be consulted (Anon 1991; Anon 2000b).

Additionally

In all cases cloths must be dried immediately after decontamination and stored dry until subsequent use to prevent the regrowth of any residual contamination.

It is important to be aware that where cloths and similar utensils become heavily contaminated as a result of misuse (e.g., by being stored in a damp condition, as is often the case in the home), they become more difficult to decontaminate because organisms are too strongly adhered. If this situation occurs they should either be discarded or treated using one of the processes described below.

SITUATIONS OF SPECIFIC RISK

In situations where the above recommendations are not, or cannot, be followed, e.g., if disposable cloths are not available to clear up spills of blood, vomit, faeces etc, or if cloths have been left in a soiled damp condition for a period and are very heavily contaminated, one of the following processes should be used:

- Rinsing with detergent and hot water followed by immersion in water held at 90°C or more for 2 minutes. This can be achieved by immersing the cloth in boiling water.
- Rinsing with detergent and hot water followed by laundering. In this situation a laundry cycle at 90°C should be used, or at 60°C in conjunction with an activated bleach-containing washing powder.

Showerheads and tap filters

Showerheads that have remained stagnant for a period of weeks create a potential for growth of microbes, including the *Legionella* bacillus and *Ps. aeruginosa*, and can become disseminators of these micro-organisms as soon as the water is switched on for someone to take a shower. The recommended solution for this problem in the home is to turn the hot water on full and allow it to flow for a while to create a flushing process before taking the first shower after an interval of no use. If the water has a temperature of 60°C or more this will increase the efficiency of the process by inactivation of bacterial contaminants (Van der Kooij 2000).

In some parts of Europe small filters are placed over taps that could also become bacterial reservoirs and will need regular cleaning to remove calcium deposits. These filters should be removed frequently and immersed in a descaler solution in order to remove scale and kill micro-organisms.

Humidifiers

Two types of humidifier are commonly available. In one, water vapour is produced by heating the water, whilst in the second type the vapour is produced by passing a draught of air over the surface of the water leading to entrainment of water droplets forming an aerosol in the air current. Use of humidifiers of the latter type should be discouraged except where medically advised. Where used, humidifiers should be refilled daily with fresh potable water and regularly descaled (weekly) to discourage the build up of biofilms and avoid dispersal of micro-organisms or spores into the room. Disinfection of the water can be achieved by the addition of hypochlorite (250 ppm or 0.025% w/v available chlorine) or hydrogen peroxide (10% v/v). In situations where build-up of biofilms has occurred through prolonged use then it will be necessary to disassemble the equipment for thorough cleaning using a descaler which will also kill micro-organisms. Note: the use of a descaler must not be combined with the use of hypochlorite bleach.

Nebulisers

These items should be rinsed with potable water immediately after use, thoroughly dried without delay and stored dry. Particular attention should be paid to the tubing and other parts of the nebuliser where small amounts of residual water readily accumulate that could support the growth of micro-organisms.

Comments on reservoir disseminators

Further work is required to better understand the role of cleaning utensils in facilitating cross contamination and cross infection in the home.

Further work is also required to evaluate the extent of the hygiene benefit derived from application of antibacterial cleaning products to cloths and other cleaning utensils in order to kill or inhibit the growth of microbes.

6.4 RESERVOIRS

Sites such as toilet bowls, U-tubes, and washbasin and bath overflows in the home can become reservoirs of micro-organisms either permanently or intermittently, which may include opportunist pathogens and primary pathogens. In these situations the presence of moisture and residual amounts of soil not only encourages the survival of microbial contamination but provides an ideal substrate for supporting the growth of a resident population of micro-organisms. Scale on the surfaces of sinks or toilet bowls can also harbour a resident population of microbes.

Toilets

It is generally considered that the risks of exposure to pathogens from the toilet bowl and water in the toilet is relatively low under normal conditions in the home. Although there is evidence that splashing and aerosol formation can occur as a result of toilet flushing, causing contamination to be transferred to other parts of toilet including hand-contact surfaces such as the toilet seat and toilet flush handles, the consensus view is that the infection risk from splashing and aerosols is small in a home where the family is healthy. Where members of the family have fluid diarrhoea, then transmission of infection via this route may occur. Data suggest that, where family members are healthy, toilet flushing is sufficient to remove most of the microbial contamination from the toilet provided that a minimum of 15-17 litres of water is used for each flush. Although this procedure will remove most of the contamination from the surface of the toilet bowl as well as the water in the bowl it does not achieve decontamination under the flushing rim of the toilet. It must also be remembered that, during toilet use, surfaces such as the toilet rim, seat and flush handle may be contaminated by direct contact or shedding.

The following processes can be used for achieving hygienic decontamination of the toilet:

- Cleaning using a detergent product and mechanical action followed by toilet flushing. The toilet bowl surface should also be descaled using an appropriate product. The effectiveness of toilet flushing as a hygiene measure depends on the volume of water used in the flush. It is recommended that a minimum of 15-17 litres of water is used for each flush.
- Cleaning using a detergent product and mechanical action followed by application of a disinfectant and toilet flushing. The toilet bowl surface should also be descaled using an

appropriate product. When choosing a disinfectant product for achieving hygiene, an agent should be selected which has rapid microbicidal action against bacterial and viral pathogens. Products should be used at concentrations and under conditions that give rapid and effective inactivation of micro-organisms. In this respect, compatibility with water hardness, effectiveness at the expected soil level and the contact time necessary for disinfection are primary considerations. For further information on disinfectants for use in the toilet, published guidelines on selection and use of disinfectant products should be consulted (Anon 1991; Anon 2000b).

IFH CONSENSUS ON RESERVOIRS

- The IFH consider that although the toilet, the sink, basin and bath U-tubes and overflows, and household drains have the potential (either intermittently or permanently) to harbour reservoirs of pathogenic microbes, unless there is vomiting or diarrhoeal disease within the family, these represent a relatively low infection risk since the risks of transfer from these sites are relatively low.
- Toilet flushing is considered sufficient to remove most of the microbial contamination from the toilet bowl and the surface of the bowl, provided that an adequate amount of water (minimum 15-17 litres of water) is used for flushing.
- Toilet flushing does not however achieve decontamination under the flushing rim of the toilet. Thus it is considered that the toilet requires regular application of a hygiene procedure which will maintain a low level of contamination in the toilet bowl and under the flushing rim to prevent build up of biofilms or scale that could harbour pathogens.
- Disinfection of sites such as sink and basin U-tubes, sink overflows and drains is considered as the appropriate means to prevent the build up of microbial biofilms at these sites.
- In situations where an infected person is known to be, or have been, present or where there is a high incidence of diarrhoeal disease, regular disinfection of the toilet is advised.
- Disinfection of sinks and sink U-tubes and overflows as well as toilets is recommended in homes where there is a person who is particularly vulnerable to infection. Toilet blocks may be useful in protecting such groups by continuously maintaining only a low level of contamination in the toilet.

6.4 RESERVOIRS

Note: where an acid descalant is used and is to be followed by disinfection with hypochlorite, the descalant **MUST** be flushed away before adding the disinfectant.

- Routine cleaning and descaling as above supplemented by the use of a toilet cistern or rim block which delivers a measured dose of disinfectant into the toilet bowl during flushing. These formulations will prevent microbial contamination in the toilet rising above an acceptable low level between flushes (Scott and Bloomfield 1985). Such formulations however are insufficient in situations where there is very significant soiling of the toilet, e.g., where there is vomiting or fluid diarrhoea.

GENERAL SITUATION

Although routine toilet flushing is considered sufficient to maintain toilets in a hygienic state, it is considered that toilets should be cleaned and made hygienic on a regular basis by one of the above procedures. In a typical household where family members are healthy, the following considerations should be taken into account:

- Under normal conditions it is considered that toilet hygiene can be achieved by mechanical cleaning with detergent and water and a descaling process, provided that the processes are applied under the flushing rim of the toilet as well as to the surface of the toilet bowl.
- To a significant degree, cleaning and/or disinfecting of these sites relates to aesthetic issues such as smell, rather than hygiene. However application of a hygiene procedure, which includes descaling of the toilet together with the flushing rim where persistent biofilms are most likely to form, is recommended as a precautionary measure to discourage the build up of resident microbial biofilms that could harbour enteric pathogens.
- Although the risks of transfer of infection from the toilet during flushing are considered relatively small in a healthy family it must be remembered that children may sometimes touch the surfaces of the toilet bowl and toilet rim whilst using the toilet. Cleaning and disinfection of the toilet or the installation of toilet blocks that maintain contamination at a consistently low level may be considered beneficial in this situation.
- In developing countries where the incidence of chronic diarrhoeal infection is high, it is recommended that toilets should be disinfected as well as cleaned and descaled on a

routine basis. This is particularly important where the toilets are frequently used or where toilets are shared by one or more families.

SITUATIONS OF SPECIFIC RISK

Situations where there is a potentially higher risk of infection transfer are as follows:

- Where there is an outbreak of infectious intestinal disease in the home, rigorous cleaning and disinfection of toilets and washbasins is important, particularly during the diarrhoeal and vomiting phase of the illness. The disinfectant should be added to the toilet bowl before flushing, and the toilet flushed with the lid down to avoid release of an aerosol. During the diarrhoeal phase of the infection the toilet should be rigorously cleaned and disinfected at least daily, ensuring that not only the surface of the bowl but also the underside of the flushing rim is decontaminated. At this time disinfection of other toilet surfaces and other hand-contact surfaces in the toilet area is advisable since significant transmission of pathogens can occur by splashing and other mechanisms (Gerba 1975; Barker and Bloomfield 2000). Regular cleaning, descaling and disinfection of the toilet and washbasins should be continued for at least 3-4 weeks after symptoms have subsided.
- Disinfection as well as cleaning of toilets and U-tubes may also be considered necessary in homes where there is an "at risk" person. Evidence exists from the hospital setting demonstrating that opportunist pathogens, e.g., *Ps. aeruginosa*, can become established as the resident flora in toilets and other wet sites. An investigation in German hospitals revealed a correlation between strains of *Ps. aeruginosa* isolated from infected patients with cystic fibrosis (for whom *Ps. aeruginosa* is a high risk) and from environmental sites such as sink U-tubes, toilets, cloths and other sites (Zimakoff *et al.* 1983; Doring *et al.* 1989, 1993; Doring 1993). As a result, routine disinfection of toilet bowls is now recommended in German hospitals especially in situations where there are patients infected with hepatitis A. In this situation toilet or rim blocks, which deliver a measured dose of disinfectant into the toilet during flushing thereby maintaining toilets in a hygienic state, may be useful in protecting vulnerable groups (Scott and Bloomfield 1985).

Sink and bath U-tubes and overflows, and drains

For sinks, handbasin and bath U-tubes, and sink overflows there is some evidence that splashback of stagnant water can occur, but how serious a risk this creates in the home is not clear.

GENERAL SITUATION

Currently there is insufficient evidence to support disinfecting U-tubes for the prevention of infection transmission although there may be other motives for using disinfection at this site, such as the eradication of smell. There is some evidence that opportunist pathogens such as *Pseudomonas* spp., *Enterobacter* spp., *Serratia* spp. and *Legionella*, can reside in areas such as the sink U-tube and the overflow of washbasins especially where there is a siphon. Since these sites cannot be thoroughly cleaned mechanically it is considered that they should be disinfected, not daily but regularly, to prevent the establishment of a persistent biofilm that may harbour pathogens.

SITUATIONS OF SPECIFIC RISK

On the basis of evidence discussed above in relation to toilets, routine daily disinfection as well as cleaning of sinks, sink U-tubes and overflows is considered advisable in homes where there is an "at risk" person.

Comments

Further research is necessary regarding the relevance and transfer of opportunist pathogens from reservoir sites, and the efficacy of disinfection and continuous release toilet blocks as a means of preventing infection transmission in the home.

Adequate flushing is the most important component of toilet hygiene. In an effort to conserve water manufacturers of sanitary fixtures are promoting low volume flushing systems that use 3-5 litres of water per flush. The World Bank/UNDP - Water & Sanitation Group is recommending hand-flushed toilets without any flushing system in developing countries. These changes are being made without regard to their possible impact on hygiene. The IFH believes that research is required to establish minimum flushing water requirement from the point of view of hygiene and sanitation and the prevention of infection.

6.5 LAUNDRY

Risk of cross infection via clothing and fabrics does exist, but under normal daily conditions in the domestic setting it is considered that this risk is low and infrequent compared with, for example, the risks from hand- and food-contact surfaces. Two occasions during the laundry process present the potential for contaminated clothing and linens to act as a disseminator of infection. The first occurs when soiled clothes and linens are handled before laundering. The second occurs if the laundry process is inadequate, particularly if the laundry remains damp for a period of time following washing. If laundry is left overnight in the machine there is the opportunity for the growth of residual micro-organisms such as bacteria and fungi, which can amplify the infection risk. In all cases the risk is predominantly to the person handling the laundry.

Changes in laundry practices that have taken place in the last ten years in Europe and North America have prompted a need to re-evaluate the hygiene of these processes. Where previously laundering was carried out using water at temperatures of 60°C or above, in recent years there has been a trend towards reducing laundering temperatures, water volumes and the usage of phosphates and bleach in the detergent products. Although frequently linked to benefits, such as saving energy and water, these changes have implications for hygiene. There is evidence that bacteria, viruses and fungi can survive certain laundry conditions, particularly where laundering is carried out at temperatures less than 30°C. There is also evidence that transfer of microbes is possible between contaminated and uncontaminated items during washing, which is only partially removed by subsequent machine rinse cycles. It is considered, however, that in most cases thorough drying of laundry further reduces contamination to a level where it no longer represents any significant risk.

The following processes are used in the laundering of clothing and linens:

- **Washing at 60°C (or above).** This is considered to give consistent hygienic decontamination across all species of organisms (bacteria, fungi and viruses) by a combination of physical removal and heat inactivation. This process is the recommended laundry process for achieving hygiene of cleaning cloths.

6.5 LAUNDRY

- Washing at 30-40°C using an activated bleach-containing powder. This process produces decontamination of fabrics from bacteria by a combination of physical removal and chemical inactivation. Decontamination from some types of fungi and viruses, which are harder to inactivate, may be less complete in this case.
- Washing exclusively at temperatures of 40°C or below using a non-bleach product. This process is considered to carry a risk of inadequate decontamination. Thorough and prompt drying of laundry as a means of disinfection is thus recommended in this situation.

GENERAL SITUATION

In a typical healthy household the following should be considered:

- As a routine, all clothing items which carry a risk of contamination with faecal or skin-borne organisms (i.e., underwear), items that may be used around food, and all cleaning utensils should be laundered as described above, either at 60°C, or at 40-60°C with an activated bleach powder. Clothing items that carry a risk of contamination with faecal or skin-borne organisms should always be segregated from items (such as tea towels) that may be used around food. Hands should always be washed after handling soiled laundry.
- Washing constantly with a non-bleach detergent at 40°C or below may permit the build up of biofilms in machines. These biofilms can allow organisms to survive, and sometimes to grow, between washes and contaminate the following wash. This risk can be controlled by running a higher temperature wash (60°C or above), preferably with an activated bleach-containing detergent, at least once a week or any time malodours are detected from the machine. Alternatively, bleach can be added to an empty wash at 60°C.
- Washing of clothing in grossly polluted water, such as polluted river water, is a major health hazard. In developing countries steps should be taken to prevent this practice and to ensure that community laundry services provided by local “washermen” have access to safe and potable water.

IFH CONSENSUS ON LAUNDRY

- The IFH consider that soiled clothing and linens can be a source of cross infection in the domestic setting if not properly handled.
- Hands should always be washed after handling soiled laundry.
- All soiled clothing and household linens that routinely carry a risk of contamination with faecal, skin-borne or other pathogens should be laundered at 60°C, or at 40-60°C using an activated bleach-containing powder.
- It is important to ensure that polluted water is not used for laundry purposes, particularly where laundry is carried out outside the home.
- It is important that laundry is dried immediately after the washing process is completed.
- At least once a week a high temperature wash or chemical disinfectant should be used to prevent the build up of biofilms within the washing machine.
- Washing at temperatures of 40°C or below using a non-bleach detergent may not provide effective decontamination.
- Where clothing is heavily soiled and is likely to be contaminated with pathogens, or where people who are particularly vulnerable to infection are present in the home it is recommended that all clothing and linens should be laundered at 90°C or at 60°C using an activated bleach-containing powder.
- In all situations, clothing items, linens and cloths which carry a risk of faecal, or other pathogenic contamination should be segregated from items such as cleaning cloths and tea towels that are used during food preparation.

SITUATIONS OF SPECIFIC RISK

Situations where there is a potentially higher risk associated with laundry are as follows:

- Fabrics significantly contaminated by faeces, vomit or other body fluids, and fabrics used by people who are known to have infections run a high risk of containing pathogens.
- There is some anecdotal evidence that where the skin surface of the hands is damaged or abraded then infection from handling linen contaminated with HIV virus has occurred. In this situation it is advised that gloves be worn during the handling of soiled laundry – although carers must be reassured that the risks are very small.
- Rigorous standards of laundry hygiene should be applied in homes where there is an immuno-compromised family member for whom the infectious dose may be very small and who may therefore be susceptible to opportunist as well as primary pathogens.

In these situations:

- It is recommended that all laundry items should be washed at 90°C or at 60°C using an activated bleach-containing washing powder. If lower temperature washes (<45°C) must be used the addition of hypochlorite bleach or other equivalent “broad spectrum” biocidal agent (i.e., agents that are effective against viruses as well as bacteria) is recommended to ensure hygienic decontamination. Note: shrinkage of garments may occur where very high temperatures are used.
- It is important that items contaminated with faeces, vomit or other infected body secretions are washed separately. Most importantly, they must be segregated from items that may be used around food.
- Loads that are most likely to be contaminated, e.g., underwear, towels and soiled bed-linen should be washed at the end of a series of loads, certainly after loads to be used by vulnerable groups or around food.
- If using a machine that takes hot water from the household boiler, it is important to bear in mind that it may not be possible to maintain a wash temperature of 60°C over several loads consecutively.
- For householders who use shared laundry facilities or commercial laundromats there is a risk of cross contamination between loads via the machine drum. In these circumstances if a 60°C wash temperature cannot be assured, additional precautions such as the use of an activated bleach-containing powder is advisable.

6.6 FLOORS, WALLS AND FURNISHINGS

For the most part, the risks of exposure to pathogens as a result of microbial contamination on floors, home furnishings and walls in the home are considered very low. It is judged, therefore, that procedures which eliminate pathogenic microbes from these surfaces are not necessary as part of routine cleaning under normal conditions. Of greater concern is the fact that particulates from floors and other surfaces, which may be contaminated with bacteria, fungi or viruses, are readily dispersed into the air and can cause allergic or mycotoxic responses if inhaled. Where fungi are able to grow on these surfaces, an occurrence associated mainly with surfaces that are damaged and in a damp condition, these can cause unacceptable discolouration and deterioration of the surface. Fungi can also produce volatile organic compounds (VOCs) that have been suggested as a contributory factor in the development of sick building syndrome. These problems are exacerbated in houses where ventilation is poor, or which are sealed to optimise air conditioning.

In situations where hygienic decontamination of floors, walls and other such surfaces is required, this may be achieved by cleaning followed by disinfection, or by using a combined disinfectant cleaner. Products should have rapid microbicidal action against bacterial and viral pathogens. Action against fungi may also be required according to the situation, but particularly for tiled areas and other damp surfaces where mould is a problem. Products should be used at concentrations and under conditions that give rapid and effective inactivation of micro-organisms. In this respect, compatibility with water hardness, effectiveness at the expected soil level and the contact time necessary for disinfection are primary considerations. For further information, published guidelines on the selection and use of disinfectant products should be consulted (Anon 1991; Anon 2000b). Antimicrobial products that claim only to "prevent growth of microbes" should be avoided except in situations where mould growth is a problem, where both immediate and sustained action may be desirable.

GENERAL SITUATION

In relation to hygiene of floors, walls and similar areas of the home the following factors should be considered:

- All surfaces should be cleaned regularly to remove dust and visible mould growth. Effective removal of dirt and dust through sweeping, vacuuming and washing with water and detergent is recommended as the appropriate procedure to reduce exposure to dust-borne organisms to an acceptable level.
- Mould growth should be removed using cleaning agents that optimise the detachment of fungal growth from surfaces, such as a detergent containing bleach. Ensuring that homes are properly maintained in order to reduce dampness to an acceptable level, that walls and surfaces are not damaged and that windows are weatherproof plays a vital part in preventing the growth of moulds. Particular attention should be paid to tiled surfaces where mould growth can become established in the grouting between tiles and in surface areas where the tile is damaged.
- Flooring with plastic materials such as linoleum must be sealed to prevent water seeping into the joints during cleaning. Wood flooring that has become damaged and is not sealed also requires careful attention.
- The IFH wish to highlight the potential problems associated with wall-to-wall carpeting. Carpets are generally more difficult to clean than uncarpeted floors. Where carpets are not regularly vacuumed, or if the efficiency of the vacuum cleaner is poor, a significant rise in suspended particulate concentrations is known to occur. Although data linking health benefits to the efficacy of vacuuming, shampooing and other methods of cleaning carpets in the home is lacking, it is considered that the level of maintenance of carpets plays a significant part in determining indoor air quality. Although regular shampooing can contribute to carpet hygiene the risk of carpets remaining damp following wet cleaning and thus supporting the growth of micro-organisms is a concern.

In Germany, in view of the hygiene implications, fitted carpets are not permitted in hospitals and patients suffering from asthma are advised to remove carpet from their home, particularly from rooms where they sleep. The IFH feel that, from a hygienic point of view, the use of fitted carpet in the family home should be discouraged, especially where there is a need for rigorous standards of infection control (e.g., the home care of vulnerable groups) or particular concern about allergies.

- Where wet cleaning equipment is used to clean floors and carpets, care must be taken to ensure that the equipment itself does not become a reservoir of infection.
- Disinfection as well as cleaning may be considered for uncarpeted floors in situations where there are very young children in the home who are not yet walking – particularly in an area such as the kitchen where pets are most usually present. Recent studies of homes in which there was an infant infected with *Salmonella* suggested the possibility that environmental sources, together with other family members and pets, were more significant risk factors than contaminated foods (Schutze *et al.* 1999).
- In hot climates where humidity is also high, it may be necessary to disinfect floors in order to control odours.

IFH CONSENSUS ON FLOORS, WALLS AND FURNISHINGS

- For the most part the risks of exposure to pathogens as a result of microbial contamination on floors, walls and furnishings are considered very low.
- In most situations, cleaning with detergent and water is considered adequate for floors, walls and furnishings.
- It is recommended that properly maintained, fitted carpet should be vacuumed thoroughly at regular intervals to lower the level of particulates and dust mites.
- Spillages of infectious material should be removed by cleaning followed by disinfection.
- If a fitted carpet cannot be properly maintained it is considered a potential health risk and should not be the floor covering of choice, particularly in families where there are small children who are not yet walking, or other groups with a higher infection risk or allergy.
- For tiled walls or other areas where damp accumulates cleaning and disinfection is advised in order to prevent the build up of fungal contamination.

SITUATIONS OF SPECIFIC RISK

Situations of specific risk which have been identified in the home are as follows:

- On wall, floor or furnishing surfaces where there have been spills of vomit, blood or faecal material, disinfection is recommended in addition to cleaning, although this may be difficult when dealing with fabrics. If the material is considered particularly infectious, e.g., vomit associated with SRSV infection, it may then be advisable to apply disinfectant to the infected material before cleaning in order to protect the person doing the cleaning. In this situation the wearing of disposable protective gloves is also advised. Disinfectant should then be reapplied to the surface after cleaning. Cheesbrough *et al.* (1997) reported carpet fitters who became ill after removing a carpet from a room next to a hospital ward where an outbreak of SRSV had occurred 13 days before removal of the carpet.
- Application of some disinfectants to carpets and soft furnishings can be a problem since they can damage or stain the fabric. An alternative method of disinfection of these surfaces is by steam cleaning but, where this is deemed necessary, it should be done professionally.
- Control of MRSA is now recognised as a community as well as a hospital problem. Significant increases in MRSA infections acquired in the community amongst hospitalised children without predisposing risk factors have been reported by Herold *et al.* (1998), Zylke (1998), Dancer and Crawford (1999). MRSA carriers shed organisms onto all types of surfaces that can remain viable for significant periods. Masterton *et al.* (1995) showed that MRSA carriage in a nurse was not eradicated until topical antimicrobial therapy was combined with environmental decontamination in her home.

6.7 WATER QUALITY

Water quality in the home is of extreme importance. Consumption of water contaminated with bacterial, viral, protozoal and other parasites is a primary cause of infectious intestinal disease, particularly in developing countries. Additionally, where contaminated water is used for bathing, food hygiene, washing of clothes and utensils, and other hygiene purposes it can act as the means of transferring pathogens around the home.

In developing countries, collection, storage and handling of drinking water is one of the major risk areas in domestic hygiene. Since hand contact with water can easily occur during collection, storage and serving, leading to contamination of the water, hand hygiene education programmes in such areas is of critical importance. Strict attention to all aspects of hygiene related to the provision of clean water in the home should be emphasised.

GENERAL SITUATION

Where the quality of the water not considered adequate for drinking or for hygiene purposes, any of the following processes can be used:

- Boiling at 100°C for 3-5 or 10 minutes. A holding period of 3-5 minutes will ensure that water is safe for drinking except in situations where contamination with spore-forming bacteria, fungal and protozoal cysts, or hepatitis virus is suspected, in which case a holding time of 10 minutes is advised.
- Chemical disinfection
 - If the water is clean (turbidity 0-5 NTU), but considered bacteriologically unsafe with low level contamination (faecal coliform count >20 MPN per 100 ml), chlorine solution, chlorine tablets or bleaching powder should be added in a quantity such that the free residual chlorine in the water is above 0.2 mg/l. The contact period should be one hour (Anon, 1990a).
 - In case of grossly polluted water sources (faecal coliform count >100 MPN per 100 ml, turbidity 5-10 NTU) the water should first be treated with some coagulant and simple domestic filtration followed by disinfection with chlorine at a similar dose and contact time as above.

6.7 WATER QUALITY

- Iodine can be considered for water treatment although chlorine has an advantage because of its residual effect and the fact that it can be used at a lower concentration. For disinfection of water with iodine a concentration of 3.7 mg/l and a contact time of 10 minutes is required in situations where contamination with bacteria and protozoa (including protozoal cysts) is suspected and 6.3 mg/l where virucidal contamination is suspected (Anon, 1990a).
- Filtration
 - The filter must be capable of removing bacterial, protozoa and other parasites. It must be remembered that filters do not offer protection against viral contamination.
 - Where water filters are used to remove excess chlorine and/or nitrates and pesticides, they should be replaced frequently to avoid their becoming reservoirs and disseminators of micro-organisms.

In relation to hygiene of water the following factors should be considered:

- In areas where a regular supply of water is non-existent or intermittent, or where water is obtained from a communal source outside the home, care must be taken to ensure that high standards of hygiene are maintained in relation to collection, storage and handling of the water – even in areas where the water is known to be of good quality at the point of collection:
 - Hand contact with water during collection and transport can recontaminate the water and must be avoided. Water storage vessels should ideally be designed to make hand contact impossible.
 - Storage vessels should be kept covered.
 - Hygiene of collection and storage vessels for domestic water use is a key issue. Families must be made aware of the dangers of continually “topping up” water in storage vessels. In this situation residual contaminated water in the vessel can initiate the formation of a permanent reservoir of water-borne pathogens in subsequent batches of water. After each use, collection and storage vessels should be thoroughly rinsed using good quality potable water or water that has been treated by one of the methods described above.
 - Water should be stored in the home for the shortest possible time.
- Where domestic water is obtained from a communal storage vessel or reservoir, it is important to ensure that the communal vessel is cleaned and rinsed each time before being refilled using good quality potable water or water that has been treated by one of the methods described above. At intervals (6/12 months) thorough scrubbing should treat the vessels or reservoirs and effective cleaning followed by super-chlorination (25-50 mg/l of chlorine for a contact period of 24 hrs). This water should be flushed out after disinfection.

SITUATIONS OF SPECIFIC RISK

- Where a water-borne outbreak is suspected, guidelines by the WHO or UNICEF should be consulted (Anon 1994, Anon 1989).
- For disinfecting surfaces of water reservoirs, containers, tubewells or borewells that might have been seriously contaminated by faecal matter and where biofilms or scale may have formed, thorough scrubbing and effective cleaning should be followed by super-chlorination (25-50 mg/l of chlorine for a contact period of 24 hrs). This water should be flushed out after disinfection.

IFH CONSENSUS ON WATER QUALITY

- Water quality is of prime importance because of its central role in the practice of home hygiene. Where good quality (i.e., potable) water is not available, boiling or other methods should be applied to produce safe water.
- Where water must be stored in the home, conditions of handling and storage are of extreme importance. Water storage vessels should be thoroughly cleaned before refilling by rinsing with good quality (i.e., potable) water. They should also be disinfected periodically. Hand contact with stored water for drinking or for hygienic cleaning must be avoided.

6.8 INDOOR AIR QUALITY

Indoor air quality, particularly in North America, is a significant concern particularly where air conditioning systems are installed. Contaminated air (e.g., air contaminated with fungal spores) can be introduced from outside the home. Alternatively, the air can become contaminated by fungal spores or particulates contaminated with bacteria, fungi or viruses present on floors and other surfaces in the home. Damp areas of the house, such as bathrooms, especially in countries where houses are not well ventilated, can promote the growth of fungi and mould. Particulates and spores are readily dispersed into the air and can cause allergic or mycotoxic responses if inhaled. Fungal spores such as *Aspergillus* spores, released into the air following renovation work, such as the disturbance of old ceiling and walls/wallpaper, can be a risk for certain immuno-compromised individuals where the spore count is high. Fungal growth can also be associated with production of malodours, mycotoxins and volatile organic compounds (VOCs) that negatively effect air quality and, for mycotoxins and VOCs, may be associated respectively with toxic effects or the development of sick building syndrome.

Humidifiers, often used to improve the comfort of the indoor air, can, if not frequently decontaminated, become reservoirs and disseminators of infection. These are mentioned in the section on reservoir disseminators.

Air quality should be maintained by good ventilation throughout the home combined with regular cleaning of surfaces to prevent the build up of particulates and fungal spores.

SITUATIONS OF SPECIFIC RISK

Recent measurements of endotoxin levels in house dust were correlated to variations in Peak Flow in respiratory symptoms in atopic children (Douwes 1998). It was also found that the presence of pets in the home was associated with higher endotoxin levels in house dust. Thus, where family members are known to have an atopic condition, maintenance of low levels of house dust by regular ventilation and cleaning is important.

IFH CONSENSUS ON INDOOR AIR QUALITY

- Optimum air quality should be maintained by good ventilation of the home.
- Prevention of dust and surface contamination is a key factor in determining air quality.
- Humidity control is a factor in controlling the growth of mould, which in turn plays a role in determining air quality.
- Where members of the family are known to be atopic, particular attention should be given to air quality.

7. OTHER RELEVANT GUIDELINES

Other guidelines which have been consulted in the preparation of this document include:

- Guidelines on the control of methicillin-resistant *Staphylococcus aureus* in the community. *Journal of Hospital Infection* (1995) **31**, 1-12.
- British Standard document BS 7152. (1991) *Guide to Choice of Chemical Disinfectants*. London: BSI Standards.
- Hygiene code for the private household, based on the Dutch situation (1999), Netherlands Nutrition Center, 2508 CK The Hague, The Netherlands.
- Hand Hygiene. *Bundesgesundheitsblatt* (2000) **43** (3) 230-233.
- List of disinfection procedures tested according to the "Guidelines for testing chemical disinfectants" and found effective by the German Society for Hygiene and Microbiology. Disinfectants Commission of the German Society for Hygiene and Microbiology (2000) Wiesbaden: mph-Verlag GmbH.
- APIC guidelines for handwashing and hand antisepsis in health care settings. Larson, E.A. (1995) *American Journal of Infection Control*, 251-269.
- Management of hospital outbreaks of gastro-enteritis due to small round structured viruses. Chadwick, P.R., Beards, G., Brown, D., Caul, E.O., Cheesborough, J., Clarke, I., Curry, A., O'Brien, S., Quigley, K., Sellwood, J. and Westmoreland, D. *Journal of Hospital Infection*, (2000) **45**, 1-105.

8. REFERENCES

- Anon (1990a) Water quality and treatment – a handbook of public water supply. 4th edition, American Water Works Association, McGraw-Hill, New York.
- Anon (1990b) Detection and enumeration of coliform organisms, thermotolerant coliform organisms and presumptive *Escherichia coli* – Part 2: Multiple Tube (most probable number) method. ISO standard 9308-2:1990
- Anon (1989) Hygiene education in water supply and sanitation programmes. IRC, International Water and Sanitation Centre, Technical Paper Series No. 27, International Red Cross, Geneva.
- Anon (1994) Guidelines for preventive and curative measures during water-borne outbreaks - UNICEF Publication, "Assisting in Emergencies".
- Anon (1997a) British Standard document BS EN 1500:1997. Chemical disinfectants and antiseptics – hygienic handrub – test method and requirements (phase 2/step 2). London: BSI Standards.
- Anon (1997b) British Standard document BS EN 1499:1997. Chemical disinfectants and antiseptics – hygienic handwash – test method and requirements (phase 2/step 2), London: BSI Standards.
- Anon (1998a) The World Health Report 1998. Life in the 21st century, a vision for all. Geneva, World Health Organisation.
- Anon (1998b) Standard methods for the examination of water and wastewater, 17th Edition, Washington DC. American Public Health Association.
- Anon (2000a) Hand Hygiene. *Bundesgesundheitsblatt*, **43** (3) 230-233.
- Anon (2000b) List of Disinfection procedures tested according to the "Guidelines for testing chemical disinfectants" and found effective by the German Society for Hygiene and Microbiology. Disinfectants Commission of the German Society for Hygiene and Microbiology. Wiesbaden: mph-Verlag GmbH.
- Anon (1991) British Standard document BS 7152. *Guide to Choice of Chemical Disinfectants*. London: BSI Standards.
- Barker, J. and Bloomfield, S.F. (2000) Survival of *Salmonella* in bathrooms and toilets in domestic homes following salmonellosis. *Journal of Applied Bacteriology* **89**, 137-144.
- Barker, J., Stevens, D. and Bloomfield S.F. (2000) Spread and prevention of virus infections in community facilities and domestic homes, in press.
- Beumer, R., Bloomfield, S.F., Exner, M., Fara, G. and Scott, E.A., (1999) The need for a home hygiene policy and guidelines on home hygiene. *Ann Ig*, **11**, 11-26. Also www.ifh-homehygiene.org/public/keynote/keyn000.htm
- Cheesbrough, J.S., Barkess-Jones, L. and Brown, D.W. (1997) Possible prolonged environmental survival of small round structured viruses. *Journal of Hospital Infection* **35**, 325-326.
- Cogan, T.A, Bloomfield, S.F. and Humphrey, T.J. (1999) The effectiveness of hygiene procedures for the prevention of cross contamination from chicken carcasses in the domestic kitchen. *Letters in Applied Microbiology*, **29**, 354-358.
- Dancer, S.J. (1999) Mopping up hospital infection. *Journal of Hospital Infection*. **43**, 85-100.
- Dancer, S.J. and Crawford, A. (1999) Keeping MRSA out of a district hospital. *Journal of Hospital Infection* **43** (suppl), S19-S27.
- Doring, G., Bareth, H., Gairing, A., Wolz, C. and Bozenhart, K. (1989) Genotyping of *Pseudomonas aeruginosa* sputum and stool isolates from cystic fibrosis patients: evidence for intestinal colonization and spreading into toilets. *Epidemiology and Infection*, **103**, 555-564.
- Doring, G. (1993) Chronic *Pseudomonas aeruginosa* lung infection in cystic fibrosis patients. In: *Pseudomonas aeruginosa as an opportunistic pathogen*. pp 245-273 Ed Campa, M. *et al.* New York: Plenum Press.
- Doring, G., Horz, J., Ortel, J., Grupp, H. and Wolz, C. (1993) Molecular epidemiology of *Pseudomonas aeruginosa* in an intensive care unit. *Epidemiology and Infection* **110**, 427-436.
- Douwes, J. (1998) Respiratory health effects of indoor microbial exposure: A contribution to the development of exposure assessment methods (1998), PhD thesis, Grafisch Service Centrum van Gils BV, Wageningen Agricultural University, The Netherlands.
- Eccles, R. (2000) Spread of the common cold and influenza. News Item January 2000, Home Hygiene & Health, IFH Web Site, www.ifh-homehygiene.org/newspage/new05.htm.
- Evans, H.S., Madden, P., Douglas, C., Adak, G.K., O'Brien, S.J., Djuretic, T., Wall, P.G. and Stanwell-Smith, R. (1998) General outbreaks of infectious intestinal disease in England and Wales: 1995 and 1996. *Communicable Disease and Public Health* **1**, 165-171.
- Exner, M., Kistemann, Th., Unger, G., Hansis, M. and Nassaur, A. (1999) Future prevention and control strategies in hospital hygiene. *Hygiene und Medizin*, **24**, 280-303.
- Gerba, C.P, Wallis, C. and Melnick, J.L. (1975) Microbiological hazards of household toilets: Droplet production and the fate of residual organisms. *Applied Microbiology* **30**, 229-237.
- Griffiths, C.J., Cooper, R.A., Gilmore, J., Davies, C. and Lewis, M. (2000) An evaluation of hospital cleaning regimes and standards. *Journal of Hospital Infection* **45**, 19-28.
- Herold, B.C., Immergluck, L.C., Maranan, M.C., Lauderdale, D.S., Gaskin, R.E., Boyle-Vavra, S., Leitch, C.D. and Daum, R.S. (1998) Community-acquired methicillin-resistant *Staphylococcus aureus* in children with no identified predisposing risk. *Journal of the American Medical Association* **279**, 593-598.

8. REFERENCES

- Jones, M.V., Rowe, G.B., Jackson, B. and Pritchard, N.J. (1986) The use of alcoholic paper wipes for routine hand cleansing: results of trials in two hospitals. *Journal of Hospital Infection* **8**, 268-274.
- Larson, E.A. (1995) APIC guidelines for handwashing and hand antisepsis in health care settings. *American Journal of Infection Control*, 251-269.
- Marieke, T., Boot, L. and Cairncross, S. (1993) Actions speak – a study of water and sanitation projects. pp 14-15 Eds. International Red Cross Water and Sanitation Centre and London School of Hygiene and Tropical Medicine. International Red Cross, Geneva.
- Masterton, R.G., Coia, J.E., Notman, A.W., Kempton-Smith, L. and Cookson, B.D. (1995) Refractory methicillin-resistant *Staphylococcus aureus* carriage associated with contamination of the home environment. *Journal of Hospital Infection* **25**, 318-319.
- Parker, M.T. (1978) The hospital environment as a source of septic infection. *Royal Society of Health Journal* **98**, 203-209.
- Rook, G.A.W and Stanford, J.L. (1998) Give us this day our daily germs. *Immunology Today*, **19**, 113-116.
- Rotter, M.L. (1997) Handwashing and hand disinfection. In: *Prevention and control of nosocomial infections*. pp 1052 - 1068. Ed Wenzel, R.P. Philadelphia: Lippincott Williams and Wilkins.
- Sattar, S.A. and Springthorpe, V.S. (1996) Transmission of viral infections through animate and inanimate surfaces and infection control through chemical disinfection. In: *Modelling disease transmission and its prevention by disinfection*. pp 224-257 Ed. Hurst, C.J. Cambridge: Cambridge University Press.
- Sattar, S.A., Tetro, J. and Springthorpe, V.S. (1999) Impact of changing societal trends on the spread of infections in American and Canadian homes. *American Journal of Infection Control* **27**, S4-S21.
- Schurmann, W. and Eggers, H.J. (1985) An experimental study on the epidemiology of enteroviruses - water and soap washing of poliovirus 1 on contaminated hands, its effectiveness and kinetics. *Medical Microbiology and Immunology* **174**, 221-236.
- Schutz, G.E., Sikes, J.D., Stefanova, R. and Cave, M.D. (1999) The home environment and Salmonellosis in children. *Paediatrics* **103**, E11-E15.
- Scott, E.A., Bloomfield, S.F. and Barlow, C.G. (1984) Evaluation of disinfectants in the domestic environment under 'in use' conditions. *Journal of Hygiene, (Cambridge)* **92**, 193-203.
- Scott, E.A. and Bloomfield, S.F. (1985) A bacteriological investigation to assess the effectiveness of a continuous release disinfectant for toilet hygiene. *Journal of Applied Bacteriology* **59**, 291-297.
- Stekelenburg and Hartog (1999) Combined cleaning is restaurants' recipe for hygiene and health. *Cleaning and Hygiene Today*, May, 91-98.
- Terpstra, P.M.J. (1998) Domestic and institutional hygiene in relation to sustainability. Historical, social and environmental implications. *International Biodeterioration and Biodegradation* **41**, 169-175.
- Van der Kooij, D. (2000) Legionella-bacterien in (drink)waterinstallaties: bedreiging en bestrijding. *Infectieziekten Bulletin* **11-3**, 47-49.
- Zimakoff, J., Hoiby, N., Rosendal, K. and Guilbert, J.P. (1983) Epidemiology of *Pseudomonas aeruginosa* infection and the role of contamination of the environment in a cystic fibrosis clinic. *Journal of Hospital Infection* **4**, 31-40.
- Zylke, J.W. (1998) Editor's note. *Journal of the American Medical Association* **279**, 598.

APPENDIX I

CHANGES IN DOMESTIC SETTINGS IN THE UNITED STATES AND CANADA THAT COULD FACILITATE THE SPREAD OF INFECTIOUS DISEASES

(Sattar S.A., *et al.* 1999)

PERSONAL HYGIENE AND PROVIDING OF CARE

Whereas the standards of personal hygiene are generally high in United States and Canadian homes, the increasing numbers of the aged, immunosuppressed, and otherwise debilitated persons in domestic settings will have a profound impact on hygienic practices in homes because such persons will require greater protection from infectious agents while making sure that any pathogens they may carry will not infect other persons in the household.

CHANGING EATING PATTERNS

Larger quantities and more varied kinds of foods are being imported and the consumption of imported fresh fruits and vegetables has already led to outbreaks of many types of enteric infections in the United States and Canada.

WATER CONSUMPTION AND QUALITY

Water pollution is rampant and increases in human populations, and the continued growth in urban centres is putting a serious strain on the limited water resources, which has led to more outbreaks of water-borne infections.

LAUNDERING PRACTICES

The domestic clothes-washing practices have changed in the past 3 decades as a result of energy conservation, environmental protection, and the changing nature of fabrics. These changes may promote the survival of pathogens on clothes, thus enhancing their potential as vehicles for infectious diseases.

ENVIRONMENTAL HYGIENE

There are increasing numbers of reports on the role of the domestic environment as sources of infections, and recent surveys show that reduced amounts of time are being spent on housekeeping.

DOMESTIC PETS

The increasing popularity of exotic pets increases the risk of humans acquiring zoonotic infections.

CLIMATE CONTROL

Heating and air conditioning can promote the growth of a variety of microbes indoors and give rise to "sick buildings".



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