



July 2010

IFH Newsheet (www.ifh-homehygiene.org)

Preventing the spread of infectious diseases – targeted hygiene as a framework for sustainable hygiene

In March 2010, IFH was invited to present at a workshop in the European Parliament. The workshop on “biocides” was organised by the European Parliamentary Committee on Environment, Public Health and Food Safety (ENVI) to brief members about the issues associated with biocide use. The presentation by Professor Sally Bloomfield highlighted the importance and potential contribution of home and everyday life hygiene to a more sustainable future by reducing the social and economic burden of infectious disease. Professor Bloomfield discussed how the IFH risk-based approach to hygiene (‘targeted’ hygiene) in the home and community provides a framework for ensuring that hygiene measures used are themselves sustainable, particularly in relation to the used of biocidal hygiene products. The presentation was based on the recent report prepared by the IFH Scientific Advisory Board on hygiene and sustainability.

The resource can be downloaded from: <http://www.ifh-homehygiene.org/IntegratedCRD.nsf/861f122a098364b98025750800643950/62812e8ac19247fe802576c60054693f?OpenDocument>

Hygiene and Sanitation Software: an overview of approaches - a new resource from the Water Supply and Sanitation Collaborative Council

This new document describes the hygiene and sanitation ‘software’ approaches that have been deployed over the last 40 years by NGOs, development agencies, national and local governments in all types of settings – urban, informal-urban and rural – in low income communities. There are many different approaches and there is often confusion over what a particular approach is designed to achieve, what it comprises, when and where it should be used, how it should be implemented or how much it costs. Moreover, the many ‘acronyms’ and ‘brand names’ in use frequently mean different things to different people. The purpose of this document is to clarify the terminology and language used, explain the different approaches and help practitioners decide which one would be best to use for a particular situation. It is intended for use both by newcomers to the subject and more experienced practitioners who wish to gain knowledge of other approaches.

The resource can be downloaded from: http://www.wsscc.org/fileadmin/files/pdf/publication/Hygiene_and_Sanitation_Software_WSSCC

In 2008, with the assistance of the Water Supply and Sanitation Collaborative Council, PIEDAR (Pakistan Institute for Environment-Development Action Research) initiated a process of local adaptation and translation of the IFH/WSSCC home hygiene training resource. The Urdu version was launched in Kabirwala in March 2009. Printed copies and CDs were given to government and international agencies, including Ministries of Health, Education and Environment, UNICEF, WHO, WSP-SA, and other key organisations for wider dissemination. PIEDAR also shared the resource with selected District Officers and its network of WASH partner schools.

Feedback from WASH member schools in Islamabad and Rawalpindi indicated that they focussed hygiene education on the following topics: What is home hygiene? What are germs? breaking the chain of infection, handwashing with soap, food and water hygiene and water purification at household level. In Kabirwala Sub-District, 27 schools reported adding the following topics to their standard lesson plans on personal, school, home and environmental hygiene: what are germs?, spread of germs, handwashing with soap, food hygiene, water hygiene and proper use of latrines. Some schools also organised talks for mothers to improve hygiene practices at home. PIEDAR has also used the resource at a number of training events for health professionals and local government officials in the Federal capital, and Punjab and Khyber-Pakhtoonkhwa provinces. The Urdu version was most helpful in situations with a heterogeneous group of trainees having different levels of professional knowledge and language skills, but less effective with completely illiterate audiences. Feedback was generally positive. Schoolteachers reported that the concepts were well explained in easy and simple language and the illustrations made the concepts easy to teach to students. Specifically, they reported using the manual to teach the following:

- How essential it was that teachers and parents regularly practiced as well as taught children to wash hands with soap for better health.
- Getting to know the places where germs survive in the home environment and spread most readily from, and the need to keep these places hygienically clean and free of germs.
- Keeping domestic animals and pets separate from home and kitchen and washing hands after taking care of them.
- Carefully washing raw food and storing eatables hygienically after cooking.
- Disposing of waste properly in bins
- Purifying water by methods such as boiling to make it safe to drink and storing it properly.

The Urdu edition of the WSSC/IFH training resource on home hygiene can be downloaded from: <http://www.ifh-homehygiene.org/IntegratedCRD.nsf/571fd4bd2ff8f2118025750700031676/84efc75831470f3e8025757c00424412?OpenDocument>

For more information contact: Mr Ayub Qutub (PIEDAR): s.a.qutub@piedar.org



It's been a busy year for e-Bug, during the 2009/10 academic year each of the 10 associate EU partner countries have implemented the e-Bug resource (pack materials, website, videos of the activities and extension activities) in their country and distributed hard-copy packs free to schools. The European Centre for Disease Prevention and Control (ECDC) has completed the translation of the e-Bug packs into the remaining 19 EU/EFTA languages and we are in the process of identifying lead partners in each of these countries to implement the resources in their schools. We are also in the process of developing a series of interactive, junior and senior school student web pages which will contain fascinating facts, revision sheets, quizzes, more games, downloadable images and much more for children to use in either the school or home environment. These pages will be available in English from October 2010 and in the other EU languages by September 2011.

For further information about the e-Bug project go to <http://www.e-bug.eu/> or contact Dr Clodna McNulty (clodna.mcnulty@hpa.org.uk) or Dr Donna Lecky (donna.lecky@hpa.org.uk) at the Health Protection Agency Primary Care Unit, Microbiology

Laboratory, Gloucestershire Royal Hospital, Great Western Road, Gloucester, GL1 3NN, UK.

Global Handwashing Day – October 15th 2010



The practice of handwashing with soap tops the international hygiene agenda on October 15th, with the celebration of Global Handwashing Day.

Global Handwashing Day is the centrepiece of a week of activities that aim to mobilise millions of people to wash their hands with soap and encourage children to become 'handwashing ambassadors'.

A range of activities will be taking place in the UK for Global Handwashing Day 2010, including a primary school art competition* (with £2500 prize money for the winning school) and a research project investigating the state of handwashing facilities in UK schools.

Individual schools will also be encouraged to participate by organising their own handwashing-related activities, including games, lessons and assemblies. To help with this, Global Handwashing Day UK partners have compiled a variety of resources for use in schools, not only for Global Handwashing Day, but for hygiene promotion throughout the year.

School resources and competition information will soon be available at www.globalhandwashingday.org.uk.

For more about Global Handwashing Day please email globalhandwashingday@lshtm.ac.uk.

**The Global Handwashing Day UK primary school competition is sponsored by GlaxoSmithKline.*

Progress on sanitation and drinking water – 2010 update

On 15 March 2010 the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP) released its latest report "Progress on sanitation and drinking-water – 2010 update". The report indicates that the world is on track to meet the MDG drinking-water target; by the end of 2008, 84% of the population was using an improved source of drinking-water. Although 1.3 billion people have gained access to improved sanitation since 1990, the world is likely to miss the MDG sanitation target by a billion people.

To download the report: http://www.wssinfo.org/download.php?id_document=1289

How do we persuade people to wash their hands?

Researchers from the London School of Hygiene have been studying the relative effectiveness of different types of messages in increasing handwashing with soap. They installed wireless devices at the entryway to UK highway service station restrooms which recorded the number of people entering, whilst sensors inside soap dispensers recorded each soap use. Motivational messages were compared for their effect on soap-use rates. The messages were displayed on an electronic screen over the entryway to the 2 restrooms, in full view of people entering. The messages were based on previous studies which have

elicited the main determinants of handwashing such as disgust, comfort, affiliation (or social norms, the desire to conform with what others do or with what appears to be socially acceptable behaviour), and habit.

Knowledge activation (e.g. messages such as “washing hands with soap avoids 47% of disease”) was most effective for women, with a relative increase in soap use of 9.4%. For men, disgust (messages such as “soap it off or eat it later”, or “Don’t take the loo with you – wash with soap”) was the most effective, increasing soap use by 9.8%. Disgust was not significantly better for women, nor was knowledge activation for men. Messages based on social norms (shake hands confidently – wash with soap) and social status (don’t be a dope – wash with soap) were effective for both genders. The data show that unobtrusive observation of behaviour in a natural setting can help identify the most effective interventions for changing behaviours of public health importance. The gender differences suggest that public health interventions should target men and women differently.

The full paper can be found at: (Am J Public Health. 2009;99:S405–S411. doi:10.2105/AJPH.2009.164160).

Bacteria in household dust – does it help – or exacerbate - asthma and wheeze?

Studies which could indicate whether there is any relationship between cleanliness and hygiene, and asthma and wheeze continue to yield conflicting results and indicate the complexity of the relationship between household dust, endotoxin and allergic diseases.

According to Maier et al (Applied and Environmental Microbiology. 2010;76:1663-7) bacteria in household dust influence whether or not a child develops asthma. . Sampling of house dust demonstrated that bacterial populations are influenced by the presence of dogs and cats and whether or not children attend day care. Importantly, dust samples collected from homes of infants, with or without pets and varying day care attendance, showed that differences in dust bacteria were linked with asthma development in children. The findings suggested that specific bacterial populations within the community could be associated with either risk or protection from asthma.

In another study presented by Rullo at the 2010 Annual Meeting of the American Academy of Allergy, Asthma and Immunology; Feb. 26-March 2, 2010; New Orleans, 104 newborns from low-income families in Brazil who were at high risk for asthma were evaluated. Dust samples taken from bedding and the infants’ bedroom floors within 6 months of birth were analysed for endotoxin and dust mites, cockroach, cat, dog, mouse and rat allergens. Although 18/95 children exhibited persistent wheezing at 60 months, the data indicated no significant link between persistent wheezing and allergen or endotoxin exposure.

In a further study, (Sordillo et al, Clinical & Experimental Allergy. 2010;40:902-10) the influence of current gram-negative bacteria (GNB) and GPB (as a biomarker for endotoxin) exposure on asthma and allergic sensitisation in school-aged children was evaluated. Exposure to GNB was inversely associated with asthma and allergic sensitisation at school age. In contrast, elevated GPB in the bed was inversely associated with current asthma but not with allergic sensitisation. School-aged endotoxin exposure remained protective in models for allergic disease adjusted for early-life endotoxin. The authors concluded that both GNB and GPB exposures are associated with decreased asthma symptoms, but may act through different mechanisms to confer protection. Endotoxin exposure in later childhood is not simply a surrogate of early-life exposure; it has independent protective effects on allergic disease.

These results follow on from a 2005 study by Thorne et al (American Journal of Respiratory and Critical Care Medicine, 2005;172:1371-7) who found a strong association between

endotoxin levels in the home and prevalence of asthma, asthma symptoms, asthma medication use, and wheezing. Relationships were strongest for bedroom floor and bedding dust. Households with higher endotoxin concentrations experienced higher prevalence of respiratory symptoms. They found that the likelihood of having recent asthma symptoms was nearly three times greater among individuals with exposure to high levels of endotoxin in the bedroom. Interestingly, they found that exposure worsens asthma symptoms in adults, regardless of whether an individual has allergies or not, suggesting that endotoxin exposure increases the risk of asthma even in non-allergic individuals.

In a plenary lecture at AAAAI, Fernando Martinez (co-author of Maier paper) provided a possible explanation for some of these divergent findings. Looking at gene polymorphisms in a component (CD14) of the TLR receptor, he described phenotypes which provided protection against development of allergic sensitisation in the presence of high levels of endotoxin, while others had no influence. Depending on the prevalence of such polymorphism in the population studied, the effect of early exposure to endotoxin could thus be observed to be protective or not.

Darwinian medicine and the 'hygiene' or 'old friends' hypothesis – does it provide a unifying explanation of the link between microbial exposure and allergic and other chronic inflammatory disorders?

In a review paper presented at the 99th Dahlem Conference on Infection, Inflammation and Chronic Inflammatory Disorders (Clinical and Experimental Immunology, 160:70–79) Professor Graham Rook makes the assumption that the current view of the hygiene hypothesis – that the recent increase in chronic inflammatory disorders is at least partly attributable to immunodysregulation resulting from lack of exposure to microorganisms – is fundamentally correct. What he argues however is that the more recently evolved 'childhood infections' are not likely to have evolved this role – and that the relevant organisms are those that have long associations with the mammalian immune system, traceable to the paleolithic or earlier periods. He identifies the essential role of these organisms to man is an example of "evolved dependence". Rook identifies that the relevant organisms are most likely to be those which were present during this period as commensals, environmental pseudocommensals subclinical infections or carrier states – and identifies mycobacteria, gut microbiota, helminths, hepatitis A, *Helicobacter pylori* and *Salmonella* as examples of organisms which meet these criteria. He concludes "This type of reasoning can potentially sharpen the focus of future epidemiology and simplify the quest for clinical solutions to the problem posed by the increasing incidence of inflammatory disorders."

Hygiene and physical barriers should be given higher priority in pandemic plans

A new review of the published literature by Jefferson et al (online BMJ 2009 Sep 21;339:b3675) further confirms that hygiene and physical measures, such as handwashing, wearing masks and isolating potentially infected patients, are highly effective in preventing the spread of viral infections. The researchers argue that these measures should be given higher priority in national pandemic preparation plans. The team set out to update their 2007 review by analysing 59 published studies on the effectiveness of physical measures to interrupt or reduce the spread of respiratory viruses such as influenza. The results show that regular handwashing (more than 10 times a day) and wearing masks, gloves and gowns were effective individually against all forms of acute infectious respiratory disease, and were even more effective when combined (only three patients would need to be treated in this way to prevent one case of respiratory disease). The highest quality trials suggested that spread of respiratory viruses can best be prevented by hygienic measures in younger children and within households.

Zoonoses in Europe: distribution and trends – the EFSA/ECDC Community Summary Report

European Centre for Disease Prevention and Control (ECDC) and the European Food Safety Authority (EFSA) have launched their annual (2010) report on zoonoses and food-borne outbreaks for 2008. The number of cases of the 3 most reported zoonotic infections, was lower in 2008 compared to 2007. Campylobacteriosis was the most commonly reported zoonosis in the EU for the last five years followed by salmonellosis and yersiniosis. The decline in salmonellosis continued, most likely as a result of the intensified control of *Salmonella* in animal populations, particularly in poultry, and better hygiene through the food chain. Listeriosis cases decreased by 11% in 2008 (1,381) compared to 2007 (1,554). A total of 3,159 confirmed cases of Shiga-toxin/verotoxin producing *E. coli* (STEC/VTEC) were reported, representing an 8.7% increase from 2007. VTEC was mainly isolated from cattle, but also from sheep and goats. In food, VTEC was detected in a considerable proportion of cow milk samples.

The report can be downloaded from: http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_1178671312912.htm

Contaminated poultry meat – an ongoing challenge

A number of recent studies show the extent to which raw food such as poultry is still contaminated with problem bacteria. The challenge is how to alert people to this in a manner which will motivate them handle these products safely, whilst not causing them to reject meat such as poultry as a food source. A recent survey of chicken meat sold at a large supermarket chain across Moscow by a consumer rights group has showed that 80% of chicken meat is contaminated with *Salmonella*. Eight chickens out of 10 had bacteria living on their skin, and one sample also had bacteria deep inside the muscles, indicating the bird was highly infected when it was killed. (For more details see http://english.ruvr.ru/rtvideo/2010/06/02/video_8972041.htm). In another report Weese et al (Letters in Applied Microbiology ISSN 0266-8254) describe a study to evaluate the prevalence of *Clostridium difficile* contamination of retail chicken from retail outlets across Ontario, Canada. *C. difficile* was isolated from 26 /203 (12.8%) chicken samples; 10 /11 (9.9%) thighs, 13 / 72 (18%) wings and 3 /20 (15%) legs. All isolates were ribotype 078, a strain that has been associated with food animals and potentially community-associated disease in humans. This is the first study to report *C. difficile* in chicken meat and raises concerns about food as a source of *C. difficile* infection. In the UK *Campylobacter* has been identified as a key food safety priority for the next five years. The draft Foodborne Disease Strategy, a roadmap for reducing food poisoning in the UK by 2015, says that the increased prevalence of the bug *Campylobacter* – found on raw chicken – is the biggest challenge for food safety in the UK. The most recent study showed that 65% of raw shop-bought chicken was contaminated with *Campylobacter*. An estimated 300,000 cases of food poisoning are attributed to *Campylobacter* every year in England and Wales alone. The Agency's proposed action on *Campylobacter* includes helping to ensure people can protect themselves from infection with *Campylobacter* by making sure they are aware of the need to avoid cross-contamination when handling raw chicken and to cook chicken thoroughly.

The full FSA strategy document can be found at:
<http://www.food.gov.uk/multimedia/pdfs/board/fsa100504v2.pdf>

Dogs can harbour more than just fleas

A study carried out by the Ohio Agricultural Research and Development Center (Lenz J, Joffe D, Kauffman M, Zhang Y, LeJeune J. *Can Vet J.* 2009;50(6):637-43) explored the impact of feeding raw meat to dogs, on the faecal prevalence of enteric pathogens. *Campylobacter jejuni* was isolated from 1/42 (2.6%) raw meat-fed dogs. *Salmonella enterica* was isolated from 2/40 (5%) of the raw meat feeds, 6/42 (14%) raw meat-fed dog faeces, none of the dogs that did not receive raw meat ($P = 0.001$), 4/38 (10.5%) of the vacuum cleaner waste samples from households where raw meat was fed, and 2/44 (4.5%) of vacuum cleaner waste samples from households where raw meat was not fed to dogs ($P = 0.41$). A questionnaire survey showed that owners may either not be aware or refuse to acknowledge the risks associated with raw meat-feeding and may thus neglect to protect themselves and their families from infection.

Windscreen water infection risk

According to a case control study carried out by the UK Health Protection Agency, car windscreen wiper water may be the cause of up to 20% of cases of Legionnaires' Disease. Stagnant, warm water is a breeding ground for the *Legionella* bacterium, which when inhaled causes pneumonia. Participants (75 sporadic cases and 67 controls) were sent a questionnaire asking about driving habits, potential sources in vehicles and known risk factors. Those most at risk, with higher odds ratios, were those who drove or travelled in a van, those who drove through industrial areas, and those who spent a lot of time in the car or who often had the car window open. Not using screen wash (pre-diluted or concentrated screen wash) in windscreen wiper fluid, and not taking showers at home were also risk factors. Factors which suggested a protective effect ($OR \leq 0.5$) were use of car, bus, train and underground as well as air conditioning in the vehicle especially when at a warm temperature.

The full paper can be found in: *European Journal of Epidemiology* 2010;25:2993-2999 (Print) 1573-7284 (Online).

Hygiene Behaviour Change in Zimbabwe through the Community Health Club Approach

Good hygiene and sanitation are critical for improving family health, but most rural communities in Africa have shown little inclination to change their traditional high risk behaviour patterns, resulting in high infant mortality due to preventable diseases. A new book by Juliet Waterkyn describes a study demonstrating that health promotion can be an effective entry point into holistic and sustainable development. Through regular training in Community Health Clubs, conventional norms and values are altered, resulting in hygiene behaviour change and a demand for sanitation. As a failed state Zimbabwe provides a test case in the sustainability of the approach, showing how health clubs, with minimal support, have empowered women to take control of their lives enabling survival in the face of hyperinflation, food shortages and HIV/AIDS. The Community Health Club Approach is now being replicated in many countries in Africa and Asia.

Waterkyn, J. (2010) *Hygiene Behaviour Change through the Community Health Club Approach: a cost effective strategy to achieve the Millennium Development Goals for improved sanitation in Africa.* Lambert Academic Publishing. Germany. ISBN: 978-3-8383-4491-1

One in five deaths in children in England and Wales is due to potentially preventable infections.

A study carried out by the UK Health Protection Agency (Ladhani et al *Pediatr Infect Dis J.* 2010;29:310-13) has indicated that infections continue to make a major contribution to deaths in children, particularly among those with underlying conditions. Infection-related deaths in children aged 28 days to 14 years who died in England and Wales between 2003 and 2005 were identified. There were 1368 infection-related deaths documented, constituting 20% of all childhood deaths. Half of the infection-related deaths in a two-year period were in children with other health problems. Underlying health problems in children dying from infectious disease included prematurity, cerebral palsy and cancer. In deaths where a specific type of infection was recorded, 59% were bacterial, 31% viral and 8% fungal. One finding which particularly worried the researchers was a high rate of deaths from some intestinal infections in children with underlying medical problems, as these are infections which would not normally be a problem in healthy children but can often be resistant to treatment.

Hygiene Practitioners Workshop Highlights

An International Hygiene Practitioners' Workshop organised by BRAC, IRC, WaterAid and WSSCC took place 1-4 February in Bangladesh. 50 prominent professionals from South and South East Asia sought to improve understanding of the key success factors to large-scale hygiene behaviour change. <http://www.irc.nl/page/51605> This workshop is part of a 5 workshop series for 2009- 2010.

LIBRARY OF RECENT PUBLICATIONS

Topic 1 – disease incidence

Jackson DJ, Johnston SL. The role of viruses in acute exacerbations of asthma. *J Allergy Clin Immunol.* 2010;125(6):1178-87; quiz 1188-9.

Viral respiratory infections are the most common cause of an acute asthma exacerbation in both children and adults and represent a significant global health burden. An increasing body of evidence supports the hypothesis that these infections cause a greater degree of morbidity in asthmatic subjects than in the healthy population, emphasising a discrepancy in the antiviral response of asthmatics. In this review the researchers discuss why such a discrepancy might exist, examining the role of the bronchial epithelium as well as the main inflammatory cells, mediators, and molecular pathways that are involved in the immune response. In addition, the potential impact of virus-induced asthma exacerbations on airway remodelling is reviewed and therapeutic options which might be of benefit in preventing the deterioration of asthma control seen following viral infection are explored.

Joseph CA, Ricketts KD. Legionnaires' disease in Europe 2007–2008. *Euro Surveill.* 2010;15(8):pii=19493. Available online:

<http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19493>

Each spring, countries that participate in the European Surveillance Scheme for Travel Associated Legionnaires' Disease (EWGLINET) are requested to submit their annual dataset of all cases of Legionnaires' disease in residents of their country with onset of illness in the preceding year. These data have been collected annually since 1994 and are used to analyse epidemiological and microbiological trends within and between countries over time. This paper presents an overview of the data collected for 2007 and 2008. A total of 5,907 cases were reported by 33 countries in 2007 and 5,960 cases by 34 countries in 2008, a similar two-year total to that recorded in 2005 and 2006 [1]. The only countries with a major difference in case numbers between 2007 and 2008 were Russia, due to a large outbreak in 2007, and Italy where cases increased by 256 in 2008 mainly due to an increase in community-acquired infections. The 779 reported deaths give a two-year case fatality rate of 6.6%. Some 243 outbreaks or clusters were detected, 150 of which were linked to travel-associated infections. As in previous years, the overall main method of diagnosis was by urinary antigen detection and the proportion of cases diagnosed by culture remained low at 8.8%, although isolation rates by country ranged from under 1% to over 40%.

Ladhani S, Pebody RG, Ramsay ME, et al. Continuing Impact of Infectious Diseases on Childhood Deaths in England and Wales, 2003-2005. *Pediatr Infect Dis J.* 2010;29(4):310-13.

Data on the contribution of specific infections to childhood deaths in developed countries are limited. Infection-related deaths in children aged 28 days to 14 years who died in England and Wales between 2003 and 2005 were identified from routine anonymised death certificate dataset provided by the Office for National Statistics to the Health Protection Agency, using predefined International Classification of Diseases codes for infection. Infections continue to make a major contribution to deaths in children, particularly among those with underlying conditions. Identification of the pathogens associated with childhood deaths should help prioritise the development of intervention strategies for reducing paediatric mortality. Linkage of death registrations to national infectious disease surveillance systems should be undertaken to strengthen monitoring of infectious deaths and evaluate the effect of interventions.

Nair H, Nokes DJ, Gessner BD, et al. Global burden of acute lower respiratory infections due to respiratory syncytial virus in young children: a systematic review and meta-analysis. Lancet. 2010;375:1545-55.

The global burden of disease attributable to respiratory syncytial virus (RSV) remains unknown. The researchers aimed to estimate the global incidence of and mortality from episodes of acute lower respiratory infection (ALRI) due to RSV in children younger than 5 years in 2005. It was estimated that 66,000–199,000 children younger than 5 years died from RSV-associated ALRI in 2005, with 99% of these deaths occurring in developing countries. Incidence and mortality can vary substantially from year to year in any one setting. Globally, RSV is the most common cause of childhood ALRI and a major cause of admission to hospital as a result of severe ALRI. Mortality data suggest that RSV is an important cause of death in childhood from ALRI, after pneumococcal pneumonia and Haemophilus influenzae type b. The development of novel prevention and treatment strategies should be accelerated as a priority.

Shaman J, Pitzer VE, Viboud C, et al. Absolute Humidity and the Seasonal Onset of Influenza in the Continental United States. PLoS Biol 8(2): e1000316. doi:10.1371/journal.pbio.1000316.

Much of the observed wintertime increase of mortality in temperate regions is attributed to seasonal influenza. A recent re-analysis of laboratory experiments indicates that absolute humidity strongly modulates the airborne survival and transmission of the influenza virus. Here, the researchers extend these findings to the human population level, showing that the onset of increased wintertime influenza-related mortality in the United States is associated with anomalously low absolute humidity levels during the prior weeks. They then use an epidemiological model, in which observed absolute humidity conditions temper influenza transmission rates, to successfully simulate the seasonal cycle of observed influenza-related mortality. The model results indicate that direct modulation of influenza transmissibility by absolute humidity alone is sufficient to produce this observed seasonality. These findings provide epidemiological support for the hypothesis that absolute humidity drives seasonal variations of influenza transmission in temperate regions.

Waterer G, Wunderink R. Respiratory infections: a current and future threat. Respirology. 2009;14(5):651-5.

Despite all the medical progress in the last 50 years pulmonary infections continue to exact and extremely high human and economic cost. This review focusses on the human, pathogen and environmental factors that contribute to the continued global burden or respiratory diseases with a particular focus on areas where we might hope to see some progress in the coming decades.

Williams CJ, Schweiger B, Diner G, et al. Seasonal influenza risk in hospital healthcare workers is more strongly associated with household than occupational exposures: results from a prospective cohort study in Berlin, Germany, 2006/07. BMC Infect Dis. 2010;10:8 (12 January 2010).

Influenza immunisation for healthcare workers is encouraged to protect their often vulnerable patients but also due to a perceived higher risk for influenza. The researchers aimed to compare the risk of influenza infection in healthcare workers in acute hospital care with that in non-healthcare workers over the same season. They conducted a prospective, multicentre cohort study during the 2006/07 influenza season in Berlin, Germany. Recruited participants

gave serum samples before and after the season, and completed questionnaires to determine their relevant exposures and possible confounding factors. The main outcome measure was serologically confirmed influenza infection (SCII), defined as a fourfold or greater rise in haemagglutination inhibition antibody titres to a circulating strain of influenza (with post-season titre at least 1:40). They recruited 250 hospital healthcare workers (mean age 35.7 years) and 486 non-healthcare workers (mean age 39.2 years) from administrative centres, blood donors and colleges. The results suggest that healthcare workers in hospitals do not have a higher risk of influenza than non-healthcare workers, although their risk of any respiratory infection is slightly raised. Household contacts seem to be more important than exposure to patients. Car ownership is a surprise finding which needs further exploration. Asymptomatic infections are common, accounting for around a third of serologically confirmed infections.

Topic 2 – Infection potential

Aiken AM, Lane C, Adak GK. Risk of Salmonella infection with exposure to reptiles in England, 2004-2007. Euro Surveill. 2010;15(22):pii=19581. Available online: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19581>

Non-typhoidal *Salmonella* infections are a common cause of gastroenteritis in England. Non-Enteritidis, non-Typhimurium *Salmonella* serotypes have gained in relative importance in recent years, but their modes of transmission are poorly understood. In a large case-case study in England between 2004 and 2007, the association between exposure to reptiles and *Salmonella* illness was investigated using multivariable logistic regression. Recent reptile exposure was associated with *Salmonella* illness with an odds ratio of 2.46 (95% confidence interval: 1.57-3.85, $p < 0.001$), with much stronger effects among children under five years of age. The exposure was rare, and a population attributable fraction was estimated as 0.9%. Among the *Salmonella* serotypes found in people exposed to reptiles, several non-Enteritidis, non-Typhimurium serotypes were strongly associated with exposure. Reptile exposure is a rare but significant risk factor for *Salmonella* illness in England, with much higher risk in children.

Aoki Y, Suto A, Mizuta K, et al. Duration of norovirus excretion and the longitudinal course of viral load in norovirus-infected elderly patients. J Hosp Infect. 2010;75:42-46.

To prevent dissemination of norovirus in semi-closed environments such as aged-care facilities, it is important to know the period of infectivity in norovirus-infected individuals. The researchers recruited 13 elderly patients aged 60–98 years with norovirus gastroenteritis (11 residents in aged-care facilities and two healthy adults) for this study, and measured the viral loads for norovirus in a total of 63 follow-up faecal samples using a real-time quantitative polymerase chain reaction assay. The average period of norovirus excretion was 14.3 days (range: 9–32 days; median: 13 days). All of the follow-up samples collected between 7 and 10 days after the onset of symptoms tested positive. Viral loads in samples collected between 14 and 18 days after the onset of symptoms were divided into three groups: those testing negative, those with $< 10^4$ copies/g stool, and those with $> 10^4$ copies/g stool. Stools from the group with $< 10^4$ copies/g stool were found to be negative for norovirus up to 21–24 days after the onset of symptoms; however, the group with $> 10^4$ copies/g stool showed prolonged norovirus excretion (up to 32 days) in stools. Although the period of infectivity of excreted viruses has not yet been clarified, these results suggest that careful attention should be taken for at least 14 days after the onset of symptoms and that the measurement of viral load in stools around 16 days after onset might be a useful method for following the course of viral shedding for each patient infected with norovirus.

Börjesson S, Matussek A, Melin S, et al. Methicillin-resistant *Staphylococcus aureus* (MRSA) in municipal wastewater: an uncharted threat? J Appl Microbiol. 2010;108:1244–51.

The aims of this study were to: (i) To cultivate methicillin-resistant *Staphylococcus aureus* (MRSA) from a full-scale wastewater treatment plant (WWTP), (ii) To characterise the indigenous MRSA-flora, (iii) To investigate how the treatment process affects clonal distribution and (iv) To examine the genetic relation between MRSA from waste water and clinical MRSA. Waste water samples were collected during 2 months at four key sites in the WWTP. MRSA isolates were characterised using spa typing, antibiograms, SSCmec typing and detection of Panton–Valentine leukocidin (PVL). MRSA could be isolated on all sampling occasions, but only from inlet and activated sludge. The number of isolates and diversity of MRSA were reduced by the treatment process, but there are indications that the process was selected for strains with more extensive antibiotic resistance and PVL+ strains. The waste water MRSA-flora had a close genetic relationship to clinical isolates, most likely reflecting carriage in the community. This study shows that MRSA survives in waste water and that the WWTP may be a potential reservoir for MRSA.

Buchholz U, Brockmann S, Duwe S, et al. Household transmissibility and other characteristics of seasonal oseltamivir-resistant influenza A(H1N1) viruses, Germany, 2007-8. Euro Surveill. 2010;15(6):pii=19483. Available online: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19483>

During the influenza season 2007-8, the proportion of seasonal influenza A(H1N1) viruses resistant to the neuraminidase inhibitor oseltamivir increased worldwide. The researchers conducted an investigation to compare patients infected with oseltamivir-resistant (ose-R) and oseltamivir-susceptible (ose-S) influenza A(H1N1) viruses regarding risk factors for resistance and the capability to transmit in the household setting. Within a cohort of 396 laboratory confirmed influenza patients from sentinel physicians the researchers conducted a nested case-control study among patients infected with A(H1N1). Thirty patients in the cohort were infected with influenza B, none with influenza A(H3N2) and 366 with A(H1N1). Of the 366 A(H1N1) viruses 52 (14%) were ose-R. Demographic characteristics, oseltamivir exposure, travel history and outcome were not significantly different between ose-S and ose-R patients. Among 133 households in the nested case-control study, secondary household attack rates in households with ose-R cases and households with ose-S cases were similar (23 versus 26%; p-value=0.54). Ose-R household status and occurrence of secondary cases were associated with an odds ratio of 0.85 (95% confidence interval 0.38-1.88). The conclusion was that seasonal ose-R influenza A(H1N1) viruses have transmitted well in the household setting.

Egert M, Schmidt I, Bussey K, Breves R. A glimpse under the rim – the composition of microbial biofilm communities in domestic toilets. J Appl Microbiol. 2010;108:1167-74.

The aim of this study was to determine the microbial composition of biofilms in domestic toilets by molecular means. Genomic DNA was extracted from six biofilm samples originating from households around Dusseldorf, Germany. While no archaeal 16S rRNA or fungal ITS genes were detected by PCR, fingerprinting of bacterial 16S rRNA genes revealed a diverse community in all samples. These communities also differed considerably between the six biofilms. Using the Ribosomal Database Project (RDP) classifier tool, 275 cloned 16S rRNA gene sequences were assigned to 11 bacterial phyla and 104 bacterial genera. Only 15 genera (representing 121 sequences affiliated with Acidobacteria, Actinobacteria, Bacteroidetes, Planctomycetes and Proteobacteria) occurred in at least half of the samples or contributed at least 10% of the sequences in a single biofilm. These

sequences were defined as 'typical' for toilet biofilms, and they were examined in more detail. Virtually all 'typical' clones were found to be closely related to bacteria or to sequences obtained from environmental sources, implicating that the flushing water is the main source of recruitment. In view of the great diversity of mostly yet-uncultured bacteria and the considerable differences between individual toilets, very general strategies appear to be most suited for the removal and prevention of toilet biofilms.

Karavarsamis N, Hamilton AJ. Estimators of annual probability of infection for quantitative microbial risk assessment. J Water Health. 2010;8(2):365-73.

Four estimators of annual infection probability were compared pertinent to Quantitative Microbial Risk Analysis (QMRA). A stochastic model, the Gold Standard, was used as the benchmark. It is a product of independent daily infection probabilities which in turn are based on daily doses. This paper proposes a simple adjustment to the Gold Standard equation accommodating periodic infection probabilities when the daily infection probabilities are unknown.

Lenz J, Joffe D, Kauffman M, et al. Perceptions, practices, and consequences associated with foodborne pathogens and the feeding of raw meat to dogs. Can Vet J. 2009;50(6):637-43.

This study explored the impact of feeding raw meat to dogs on the faecal prevalence of several enteric bacterial zoonotic pathogens. *Campylobacter jejuni* was isolated from 1/42 (2.6%) raw meat-fed dogs. *Salmonella enterica* was isolated from 2/40 (5%) of the raw meat feeds, 6/42 (14%) raw meat-fed dog faeces, none of the dogs that did not receive raw meat ($P = 0.001$), 4/38 (10.5%) of the vacuum cleaner waste samples from households where raw meat was fed, and 2/44 (4.5%) of vacuum cleaner waste samples from households where raw meat was not fed to dogs ($P = 0.41$). Responses to a questionnaire probing practices and beliefs regarding raw meat feeding that was administered to dog owners demonstrated that dog owners may either not be aware or refuse to acknowledge the risks associated with raw meat-feeding; thus, they may neglect to conduct adequate intervention strategies to prevent zoonoses among themselves and their families.

Liao VH, Chio CP, Chou WC, et al. Modeling human health risks of airborne endotoxin in homes during the winter and summer seasons. Sci Total Environ. 2010;408(7):1530-7. Epub 2010 Jan 27.

Endotoxin, a component of gram-negative bacterial cell walls, is a pro-inflammatory agent that induces local and systemic inflammatory responses in normal subjects which can contribute to the risk of developing asthma and chronic obstructive lung diseases. A probabilistic approach linking models of exposure, internal dosimetry, and health effects was carried out to quantitatively assess the potential inhalation risk of airborne endotoxin in homes during the winter and summer seasons. The study offers a risk-management framework for discussion of future studies of human respiratory exposure to airborne endotoxin.

Loeffler A, Pfeiffer DU, Lloyd DH, et al. Meticillin-resistant *Staphylococcus aureus* carriage in UK veterinary staff and owners of infected pets: new risk groups. J Hosp Infect. 2010;74(3):282-8. Epub 2010 Jan 18.

Meticillin-resistant *Staphylococcus aureus* (MRSA) nasal carriage on admission to hospital remains one of the most important risk factors for subsequent infection. Identification of high

risk groups for MRSA carriage is vital for the success of infection control programmes. Veterinary staff may be one such risk group but little is known about pet owners and the role of contact with infected pets. As part of a UK-wide case-control study investigating risk factors for MRSA infection in dogs and cats between 2005 and 2008, 608 veterinary staff and pet owners in contact with 106 MRSA and 91 meticillin-susceptible *S. aureus* (MSSA)-infected pets were screened for *S. aureus* nasal carriage. This study indicates for the first time an occupational risk for MRSA carriage in small animal general practitioners. Veterinary staff and owners of MRSA-infected pets are high risk groups for MRSA carriage despite not having direct hospital links. Strategies to break the cycle of MRSA infection must take these potential new reservoirs into account.

Sadat-Ali M, Al-Omran AK, Azam Q, et al. Bacterial flora on cell phones of health care providers in a teaching institution. Am J Infect Control. 2010;38(5):404-5. Epub 2010 Apr 2.

The researchers conducted a cross-sectional study involving culture of cell phones of 288 healthcare providers (HCP) during a 6-month period. One hundred nine (43.6%) HCP carried infective organisms on their cell phones. It is recommended that cell phones be cleaned regularly.

Wallensten A, Oliver I, Ricketts K, et al. Windscreen wiper fluid without added screenwash in motor vehicles: a newly identified risk factor for Legionnaires' disease. Eur J Epidemiol. 2010 Jun 8. [Epub ahead of print].

A source of infection is rarely identified for sporadic cases of Legionnaires' disease. The researchers found that professional drivers are five times more commonly represented among community acquired sporadic cases in England and Wales than expected. They investigated possible risk exposures in relation to driving or spending time in a motor vehicle. A case control study including all surviving community acquired sporadic cases in England and Wales with onset between 12 July 2008 and 9 March 2009 was carried out. Multivariable analysis identified two exposures linked to vehicle use associated with an increased risk of Legionnaires' disease: Driving through industrial areas and driving or being a passenger in a vehicle with windscreen wiper fluid not containing added screen wash. Not adding screen wash to windscreen wiper fluid is a previously unidentified risk factor and appears to be strongly associated with community acquired sporadic cases of Legionnaires' disease. A simple recommendation to use screen wash may mitigate transmission of Legionella bacteria to drivers and passengers.

Weese JS, Reid-Smith RJ, Avery BP, et al. Detection and characterization of Clostridium difficile in retail chicken. Lett Appl Microbiol. 2010;50:362-5.

This study was designed to evaluate the prevalence of *Clostridium difficile* contamination of retail chicken. Chicken legs, thighs and wings were purchased using a standardised method from retail outlets across Ontario, Canada. Selective culture was used for qualitative and quantitative detection of *C. difficile*. *Clostridium difficile* was isolated from 26/203 chicken samples. All isolates were ribotype 078, a strain that has been associated with food animals and potentially community-associated disease in humans. All positive samples were positive only on enrichment culture. *Clostridium difficile* could be found relatively commonly in retail chicken meat, albeit at low levels. This is the first study to report *C. difficile* in chicken meat. Contamination of meat with *C. difficile* strains implicated in human infections raises concerns about food as a source of *C. difficile* infection. The relevance of food contamination is completely unclear at this point but food should be investigated as a source of infection.

Topic 3 – Hygiene procedures

Bajszár G, Dekonenko A. Stress-induced Hsp70 gene expression and inactivation of *Cryptosporidium parvum* oocysts by chlorine-based oxidants. *Appl Environ Microbiol.* 2010 Jan 29. [Epub ahead of print]

This research on the mechanisms of action of chlorine-based oxidants on *Cryptosporidium parvum* oocysts in water revealed a dual-phase effect: 1) response to oxidative stress, which was demonstrated by induced expression of the Hsp70 heat-shock gene, and 2) oocyst inactivation as a result of long-term exposure to oxidants. The relative biocidal effect of sodium hypochlorite (bleach) and electrolytically generated mixed oxidant solution (MOS) on *C. parvum* oocysts was compared at identical free chlorine concentrations. Oocyst inactivation was determined by qRT-PCR amplification of the heat-induced Hsp70 mRNA and compared with tissue culture infectivity. According to both assays, within the range between 25 and 250 mg/L free chlorine and 4 hours contact time, MOS exhibits a higher efficacy in oocyst inactivation than hypochlorite. Other RNA-based viability assays, aimed at monitoring the levels of beta-tubulin mRNA and 18S rRNA showed relatively slow decay rate of these molecules following disinfection by chlorine-based oxidants, rendering these molecular diagnostic viability markers inappropriate for disinfection efficacy assessment.

Bloss R, Meyer S, Kampf G. Adsorption of active ingredients of surface disinfectants depends on the type of fabric used for surface treatment. *J Hosp Infect.* 2010;75(1):56-61. Epub 2010 Mar 17.

The disinfection of surfaces in the immediate surroundings of a hospitalised patient is considered to be an important element for prevention of nosocomial infection. The type of fabric in a mop, however, has to the researchers knowledge never been regarded as relevant for an effective disinfection of surfaces. They studied the adsorption of benzalkonium chloride (BAC), glutardialdehyde and propan-1-ol from working solutions of three surface disinfectants to four different types of fabric (A: white pulp and polyester; B: viscose rayon; C: polyester; D: mixture of viscose, cellulose and polyester). The working solutions of each disinfectant were exposed to each fabric for up to 24 h. Before and after exposure, tissues were removed and squeezed in a standardised way. The eluate was used for determination of the concentration of the active ingredient in quadruplicate. The analysis of glutardialdehyde and BAC was performed using high performance liquid chromatography; the analysis of propan-1-ol was done using gas chromatography. Only with the polyester fibre tissue were BAC concentrations found in the range of the calculated BAC concentrations. Glutardialdehyde and propan-1-ol did not adsorb to any of the fibres. Effective surface disinfection also includes selection of an appropriate fabric.

Coulon C, Collignon A, Mc Donnell G, et al. Resistance of *Acanthamoeba* spp. cysts to disinfection treatments used in healthcare settings. *J Clin Microbiol.* 2010 Jun 2. [Epub ahead of print]

Free-living amoebae that belong to the genus *Acanthamoeba* are widespread in the environment, including water. They are responsible for human infections and can host pathogenic micro-organisms. In unfavourable conditions they form cysts with high resistance to disinfection methods, thus potentially representing a threat for public health. This study evaluates the efficacy of various biocides against trophozoites and cysts of several *Acanthamoeba* strains. It demonstrates that disinfectant efficacy varies depending on strains tested, with environmental strains demonstrating greater resistance than collection strains. The results highlight the need to consider the effective disinfection of protozoa in their

vegetative and resistant forms due to their intrinsic resistance. This is not only important to prevent the transmission of protozoa themselves, but also due to the risks associated with a range of microbial pathogens that are found to be associated intracellularly with these microorganisms.

Diab-Elschahawi M, Assadian O, Blacky A, et al. W. Evaluation of the decontamination efficacy of new and reprocessed microfibre cleaning cloth compared with other commonly used cleaning cloths in the hospital. Am J Infect Control. 2010;38(4):289-92. Epub 2010 Jan 31.

The aim of this study was to investigate the decontamination capacity of 4 different types of cleaning cloths (microfibre cleaning cloth, cotton cloth, sponge cloth, and disposable paper towels) commonly used in hospital in their ability to reduce microbial loads from a surface used dry or wet in new condition. All of the cloths except disposable paper towels were also compared after 10 and 20 times of reprocessing, respectively, at 90 degrees C for 5 minutes in a washing machine. Microfibre cloths showed the best results when being used in new condition. However, after multiple reprocessing, cotton cloth showed the best overall efficacy. The study results suggest that the choice of the cleaning utilities should be based on their decontamination efficacy after several reprocessings and recommend the establishment of strict and well-defined cleaning and disinfection protocols.

Gallimore CI, Taylor C, Gennery AR, et al. Contamination of the hospital environment with gastroenteric viruses: comparison of two pediatric wards over a winter season. J Clin Microbiol. 2008;46(9):3112-5. Epub 2008 Jul 9.

The aims of this study were to examine the extent of gastroenteric virus contamination in a paediatric primary immunodeficiency (PPI) ward and a general paediatric ward over a winter season and to determine whether changes to hospital infection control interventions would have an impact on environmental contamination levels within pediatric units. Environmental swabs were collected weekly from 11 sites in both wards from 15 December 2005 to 3 March 2006 and examined for the presence of norovirus (NoV), astrovirus, and rotavirus (RV) by reverse transcriptase PCR. Overall, changes to cleaning protocols were deemed to have reduced the level of environmental contamination with gastroenteric viruses, but contamination still occurred due to a breakdown in infection control procedures indicated by contamination in areas frequented by parents but used only occasionally by staff.

Girard M, Ngazoa S, Mattison K, Jean J. Attachment of noroviruses to stainless steel and their inactivation, using household disinfectants. J Food Prot. 2010;73:400-4.

The aims of this study were (i) to evaluate the impact of pH and relative humidity on the attachment of norovirus (NoV) to fomites and (ii) to evaluate the effectiveness of different household disinfectants on NoV attached to fomites. Plaque assay and/or real-time reverse transcription PCR assay were used to determine the amount of murine and human NoV attached to stainless steel disks, i.e., the amount removed by sonication in elution buffer but not by surface rinses with water only. An enzymatic pretreatment was used for both human and murine NoV before the real-time reverse transcription PCR assay to avoid detection of RNA associated with inactivated virus. The results will help improve strategies for decontaminating surfaces harbouring NoV and thus reduce the incidence of illness caused by these pathogens in the food sector and domestic environments.

Goroncy-Bermes P, Koburger T, Meyer B. Impact of the amount of hand rub applied in hygienic hand disinfection on the reduction of microbial counts on hands. J Hosp Infect. 2010;74(3):212-8. Epub 2010 Jan 12.

Two different hand rubs were tested in order to investigate the minimum volume required for microbicidal efficacy according to the European Norm EN 1500; the researchers also sought to determine whether there is a correlation with hand size. Eight male volunteers with big hands (mean 184 cm²) and eight female volunteers with significantly smaller hands (mean 148 cm²; $P < 0.001$) participated in the study. Application of 2 mL of both products (P) provided mean log₁₀ reductions significantly smaller than those of the reference disinfectant (R) (product A: $P = 3.34$, $R = 4.00$, $P = 0.001$; product B: $P = 3.37$, $R = 3.75$, $P = 0.022$). Higher volumes (product A: 3 and 4 mL; product B: 2.5, 3 and 4 mL) ensured that the pass criteria of the European Norm (EN) 1500 were fulfilled. For both products log₁₀ reductions increased with increasing product volume until a plateau was reached. For the smaller female hands, this plateau level was reached after applying 3 mL of product A and 2.5 mL of product B. The plateau level on male hands was observed after treating the hands with $>$ or $= 4$ mL of product A and 3 mL of product B. The increase in product volume also correlated with the decrease in the number of volunteers considering the product volume applied as insufficient. In conclusion, the applied volume for hygienic hand rub should not fall below 3 mL in order to achieve maximum benefit.

Grayson ML, Melvani S, Druce J, et al. Efficacy of soap and water and alcohol-based hand-rub preparations against live H1N1 influenza virus on the hands of human volunteers. Clin Infect Dis. 2009;48(3):285-91.

Although pandemic and avian influenza are known to be transmitted via human hands, there are minimal data regarding the effectiveness of routine hand hygiene protocols against pandemic and avian influenza. Twenty vaccinated, antibody-positive healthcare workers had their hands contaminated with 1 mL of tissue culture infectious dose and 1 mL live human influenza A virus before undertaking 1 of 5 hand hygiene protocols. H1N1 concentrations were assessed before and after each intervention by viral culture and real-time reverse-transcriptase polymerase chain reaction (PCR). The natural viability of H1N1 on hands for > 60 min without hand hygiene was also assessed. The results led the investigators to conclude that hand hygiene with soap and water (SW) or alcohol-based hand rub is highly effective in reducing influenza A virus on human hands, although SW is the most effective intervention. Appropriate hand hygiene may be an important public health initiative to reduce pandemic and avian influenza transmission.

Greatorex JS, Page RF, Curran MD, et al. Effectiveness of common household cleaning agents in reducing the viability of human influenza A/H1N1. PLoS One. 2010 Feb 1;5(2):e8987.

The purpose of this work was to test a representative range of common household cleaning agents for their effectiveness at killing or reducing the viability of influenza A virus. Active ingredients in a number of the cleaning agents, wipes, and tissues tested were able to rapidly render influenza virus nonviable, as determined by plaque assay. Commercially available wipes with a claimed antiviral or antibacterial effect killed or reduced virus infectivity, while non-microbiocidal wipes and those containing only low concentrations ($< 5\%$) of surfactants showed lower anti-influenza activity. The findings indicate that it is possible to use common, low-technology agents such as 1% bleach, 10% malt vinegar, or 0.01% washing-up liquid to rapidly and completely inactivate influenza virus. Thus, in the context of the ongoing pandemic, and especially in low-resource settings, the public does not need to source specialised cleaning products, but can rapidly disinfect potentially contaminated surfaces with agents readily available in most homes.

Guilhermetti M, Marques Wiirzler LA, Castanheira Facio B, et al. Antimicrobial efficacy of alcohol-based hand gels. J Hosp Infect. 2010;74(3):219-24. Epub 2010 Jan 12.

In recent years, several commercial alcohol-based hand gels have appeared on the market to improve the hand-cleansing compliance of healthcare workers. Although the antimicrobial efficacy of these products has been reported in different countries, few studies have investigated this subject in Brazil. In this study, the investigators assessed the antimicrobial efficacy of 12 alcohol-based hand gels produced in Brazil, containing 70% w/w or v/v ethyl alcohol as the active ingredient, according to the European Standard EN 1500 (EN 1500). The following alcohol gels were tested: Hand Gel, Voga Gel, Solumax Solugel, Doctor Clean, Rio Gel, Clear Gel, Sevengel, Hand CHC, Gel Bac, WBL-50 Gel, Sanigel and Soft Care Gel. In addition, 70% w/w ethyl alcohol and three alcohol-based hand rubs (Sterillium, Sterillium Gel, and Spitaderm), commonly used in Europe and effective according to EN 1500, were also tested. All the products tested, except for two, were approved by the EN 1500 test protocol with a 60s application. The results confirmed the antimicrobial efficacy of the majority of the alcohol gels produced in Brazil for hand hygiene of healthcare workers.

Hacek DM, Ogle AM, Fisher A, et al. Significant impact of terminal room cleaning with bleach on reducing nosocomial *Clostridium difficile*. Am J Infect Control. 2010;38(5):350-3. Epub 2010 Jan 31.

The investigators were alerted to increased rates of *Clostridium difficile*-positive tests at all 3 hospitals in their healthcare system. In response, an intervention of terminal room cleaning with dilute bleach was instituted to decrease the amount of *C difficile* environmental spore contamination from patients with *C difficile* infection (CDI). The intervention consisted of replacing quaternary ammonium compound as a room cleaning agent with dilute bleach to disinfect rooms of patients with CDI upon discharge. All surfaces, floor to ceiling, were wiped with dilute bleach applied with towels to thoroughly wet the surfaces. Daily room cleaning remained unchanged. Patients remained on *C difficile* contact isolation precautions until discharge. The results demonstrate that there was a 48% reduction in the prevalence density of *C difficile* after the bleaching intervention. The implementation of a thorough, all-surface terminal bleach cleaning programme in the rooms of patients with CDI has made a sustained, significant impact on reducing the rate of nosocomial CDI in this healthcare system.

Pickering AJ, Davis J, Walters SP, et al. Hands, water, and health: faecal contamination in Tanzanian communities with improved, non-networked water supplies. Environ Sci Technol. 2010;44(9):3267-72.

This study measured levels of *E. coli*, faecal streptococci, and occurrence of the general Bacteroidales faecal DNA marker in source water, in stored water, and on hands in 334 households among communities in Dar es Salaam, Tanzania, where residents use non-networked water sources. Levels of faecal contamination on hands of mothers and children were positively correlated to faecal contamination in stored drinking water within households. Household characteristics associated with hand contamination included mother's educational attainment, use of an improved toilet, an infant in the household, and dissatisfaction with the quantity of water available for hygiene. In addition, faecal contamination on hands was associated with the prevalence of gastrointestinal and respiratory symptoms within a household. The results suggest that reducing faecal contamination on hands should be investigated as a strategy for improving stored drinking water quality and health among households using non-networked water supplies.

Jeong EK, Bae JE, Kim IS. Inactivation of influenza A virus H1N1 by disinfection process. Am J Infect Control. 2010;38(5):354-60. Epub 2010 Apr 28.

This study was conducted to evaluate the efficacy of disinfection processes, which can be easily operated at hospitals, in inactivating influenza A virus H1N1. The effects of 0.1 mol/L NaOH, 70% ethanol, 70% 1-propanol, solvent/detergent using 0.3% tri (n-butyl)-phosphate and 1.0% Triton X-100, heat, and ethylene oxide (EO) treatments in inactivating H1N1 were determined. The results led the investigators to conclude that common disinfectants, heat, and EO tested in this study were effective at inactivating H1N1. These results would be helpful in implementing effective disinfecting measures to prevent hospital-acquired infections.

Kitajima M, Tohya Y, Matsubara K, et al. Chlorine inactivation of human norovirus, murine norovirus and poliovirus in drinking water. Lett Appl Microbiol. 2010 May 14. [Epub ahead of print]

The aim of this study was to evaluate the reduction of human norovirus (HuNoV) by chlorine disinfection under typical drinking water treatment conditions. HuNoV, murine norovirus (MNV) and poliovirus type 1 (PV1) were inoculated into treated water before chlorination, collected from a drinking water treatment plant, and bench-scale free chlorine disinfection experiments were performed for two initial free chlorine concentrations, 0.1 and 0.5 mg l(-1). MNV was inactivated faster than PV1, and there was no significant difference in the viral RNA reduction rate between HuNoV and MNV. The results suggest that appropriate water treatment process with chlorination can manage the risk of HuNoV infection via drinking water supply systems. The data obtained in this study would be useful for assessing or managing the risk of HuNoV infections from drinking water exposure.

Liu P, Yuen Y, Hsiao HM, et al. Effectiveness of Liquid Soap and Hand Sanitizer against Norwalk Virus on Contaminated Hands. Appl Environ Microbiol. doi:10.1128/AEM.01729-09

The purpose of this study was to screen sodium hypochlorite and ethanol for efficacy against Norwalk virus (NV) and expand the studies to evaluate the efficacy of antibacterial liquid soap and alcohol-based hand sanitiser for the inactivation of NV on human finger pads. Samples were tested by RT-qPCR both with and without a prior RNase treatment. Using the ASTM standard finger pad method and a modification thereof (with rubbing), the investigators observed the greatest reduction in genomic copies of NV cDNA with the antibacterial liquid soap treatment (0.67-1.20 log₁₀ reduction) and water rinse only (0.58-1.38 log₁₀ reduction). The alcohol-based hand sanitiser was relatively ineffective, reducing the genomic copies of NV cDNA by only 0.14-0.34 log₁₀ compared to baseline. Although the concentrations of genomic copies of NV cDNA were consistently lower on finger pad eluates pre-treated with RNase compared to those without prior RNase treatment, these differences were not statistically significant. Despite the promise of alcohol-based sanitisers for the control of pathogen transmission, they may be relatively ineffective against the HuNoV, reinforcing the need to develop and evaluate new products against this important group of viruses.

Meyer B, Morin VN, Rödger HJ, et al. European Standard Disinfectant tests truly simulate in-use microbial and organic soiling conditions on food preparation surfaces? J Appl Microbiol. 2010;108(4):1344-51. Epub 2009 Aug 19.

The results from European standard disinfectant tests are used as one basis to approve the use of disinfectants in Europe. The design of these laboratory-based tests should thus

simulate as closely as possible the practical conditions and challenges that the disinfectants would encounter in use. No evidence is available that the organic and microbial loading in these tests simulates actual levels in the food service sector. Total organic carbon (TOC) and total viable count (TVC) were determined on 17 visibly clean and 45 visibly dirty surfaces in two restaurants and the food preparation surfaces of a large retail store. These values were compared to reference values recovered from surfaces soiled with the organic and microbial loading, following the standard conditions of the European Surface Test for bactericidal efficacy, EN 13697. The TOC reference values for clean and dirty conditions were higher than the data from practice, but cannot be regarded as statistical outliers. This was considered as a conservative assessment; however, as additional nine TOC samples from visibly dirty surfaces were discarded from the analysis, as their loading made them impossible to process. Similarly, the recovery of test organisms from surfaces contaminated according to EN 13697 was higher than the TVC from visibly dirty surfaces in practice; though they could not be regarded as statistical outliers of the whole data field. No correlation was found between TVC and TOC in the sampled data, which re-emphasises the potential presence of micro-organisms on visibly clean surfaces and thus the need for the same degree of disinfection as visibly dirty surfaces.

Muhammad N, Sinha R, Krishnan R, et al. Evaluating a composite cartridge for small system drinking water treatment. J Water Health. 2010;8(2):212-3.

A pilot-scale evaluation was conducted at the US Environmental Protection Agency (EPA) Test & Evaluation (T&E) Facility in Cincinnati, Ohio, on a multi-layer, cartridge-based system that combines physical filtration with carbon adsorption and ultraviolet (UV) light disinfection to serve as a home-base water treatment security device against accidental or intentional contaminant events. The system was challenged with different levels of turbidity, a number of biological contaminants including *Bacillus subtilis*, *Escherichia coli*, MS2 bacteriophage and Polystyrene Latex (PSL) beads as a surrogate for *Cryptosporidium* and a number of chemical contaminants including super-chlorination, methyl tertiary butyl ether (MTBE), water chlorination disinfection byproducts (DBPs) and diazinon. The results demonstrated that the performance of the system varies as a function of the specific contaminant or surrogate. The overall performance indicated the potential of the system to improve the quality and safety of household water and to serve as an additional treatment barrier in circumstances where there is little or no treatment or where the quality of treated water may have deteriorated during distribution.

Pappen FG, Qian W, Aleksejūnienė J, et al. Inhibition of Sodium Hypochlorite Antimicrobial Activity in the Presence of Bovine Serum Albumin. J Endod. 2010;36(2):268-71. Epub 2009 Dec 4.

This study investigated the inhibition of the antimicrobial activity of sodium hypochlorite (NaOCl) by bovine serum albumin (BSA). The killing of *Enterococcus faecalis*, *Candida albicans*, *Staphylococcus epidermidis*, and *Escherichia coli* by NaOCl in concentrations from 2% to 0.03% was measured in the presence of BSA in concentrations between 6.7% and 0.1%. NaOCl, BSA, and microorganism suspensions were mixed, and, after 30 seconds, 6 minutes, and 30 minutes, samples were taken and NaOCl was inactivated by 5% sodium thiosulphate. The microbes were incubated in tryptic soy broth for up to 7 days for the detection of growth. All microorganisms were killed within 30 seconds by 0.03% NaOCl when BSA was not present. High concentrations of BSA significantly reduced the antimicrobial activity of NaOCl against the four species. The inhibition of sodium hypochlorite by BSA was directly dependent on their quantitative relationships. The result partly explains the poorer performance in vivo of NaOCl as compared to in vitro experiments.

Rutala WA, Peacock JE, Gergen MF, et al. Efficacy of hospital germicides against adenovirus 8, a common cause of epidemic keratoconjunctivitis in health care facilities. Antimicrob Agents Chemother. 2006;50(4):1419-24.

The inactivation of virus-contaminated nonporous inanimate surfaces was investigated using adenovirus type 8, a common cause of epidemic keratoconjunctivitis. Twenty-one different germicides (including disinfectants and antiseptics) were selected for this study based on their current uses in healthcare. After a 1- or 5-minute exposure to 50 microl of the germicide, the virus-germicide test mixture was neutralised and assayed for infectivity. Only five disinfectants proved to be effective against the test virus at 1 min. Four other disinfectants showed effectiveness under four of the five testing conditions. Of the germicides suitable for use as an antiseptic, 70% ethanol achieved a 3-log₁₀ reduction under four of the five test conditions. These results emphasise the need for proper selection of germicides for use in disinfecting noncritical surfaces and semi-critical medical devices (such as applanation tonometers) in order to prevent outbreaks of epidemic keratoconjunctivitis.

Steinmann J, Becker B, Bischoff B, et al. Virucidal activity of 2 alcohol-based formulations proposed as hand rubs by the World Health Organization. Am J Infect Control. 2010;38(1):66-8. Epub 2009 Nov 8.

The virucidal activity of 2 hand rubs proposed by the World Health Organization was studied in a quantitative suspension test for chemical disinfectants and antiseptics in human medicine (EN 14476). These formulations are recommended if no hand rubs with declared microbiological activity are available in healthcare settings. Formulation I, based on ethanol, inactivated bovine viral diarrhoea virus (BVDV), hepatitis C virus (HCV), adenovirus, and murine norovirus as a surrogate for human norovirus. Formulation II, based on isopropyl alcohol, was active only against adenovirus and enveloped viruses, such as BVDV and HCV. Both formulations failed to inactivate poliovirus by 4 log₁₀ steps within 300 seconds.

Toshima Y, Ojima M, Yamada H, et al. Observation of everyday hand-washing behavior of Japanese, and effects of antibacterial soap. Int J Food Microbiol. 2001;68(1-2):83-91.

People wash their hands only for a short time outside the home and when preparing meals at home. This may not be sufficient for those who prepare meals because of possible secondary contamination from food. Although washing with a placebo soap for a short period (lathering 3 s and rinsing 8 s) cleansed from hands about 95% of the total coliforms transferred from ground meat, an antibacterial soap further reduced the coliform count significantly ($p < 0.01$). To effectively avoid secondary contamination, it is recommended that people should more frequently wash their hands, using an antibacterial soap on the areas that have been in contact with raw meat, poultry, seafood, eggs, vegetables and other foods.

Toté K, Horemans T, Vanden Berghe D, et al. Inhibitory effect of biocides on viable mass and matrix of *Staphylococcus Aureus* and *Pseudomonas Aeruginosa* biofilms. Appl Environ Microbiol. 2010 Apr 2. [Epub ahead of print]

Bacteria and matrix are essential for the development of biofilms and assays should therefore target both components. The current European guidelines for biocidal efficacy testing are not adequate for sessile growing microorganisms; hence alternative discriminatory test protocols should be used. The activity of a broad range of biocides was evaluated on *Staphylococcus aureus* and *Pseudomonas aeruginosa* biofilms using such in vitro assays. Nearly all selected biocides showed a significant decrease in *S. aureus* biofilm

viability, with sodium hypochlorite and peracetic acid as the most active biocides. When focusing on the matrix, only hydrogen peroxide and sodium hypochlorite showed some inhibitory effect. Treatment of *P. aeruginosa* biofilms was roughly comparable to *S. aureus*. Peracetic acid was the most active on viable mass within 1 min of contact. Isopropanol ensured a greater than 99.999% reduction of *P. aeruginosa* viability after a least 30 min of contact. Comparable to *S. aureus*, sodium hypochlorite and hydrogen peroxide markedly reduced *P. aeruginosa* matrix. This study clearly demonstrated that despite their aspecific mechanisms of action, most biocides were only active against biofilm bacteria, leaving the matrix undisturbed. Only hydrogen peroxide and sodium hypochlorite were active on both biofilm matrix and viable mass, making them the better anti-biofilm agents. In addition, this study also emphasises the need for updated and standardised guidelines for biofilm susceptibility testing of biocides.

Turner RB, Fuls JL, Rodgers ND. Effectiveness of hand sanitizers with and without organic acids for removal of rhinovirus from hands. Antimicrob Agents Chemother. 2010;54(3):1363-4. Epub 2010 Jan 4.

These studies evaluated the effectiveness of ethanol hand sanitisers with or without organic acids to remove detectable rhinovirus from the hands and prevent experimental rhinovirus infection. Ethanol hand sanitisers were significantly more effective than handwashing with soap and water. The addition of organic acids to the ethanol provided residual virucidal activity that persisted for at least 4 h. Whether these treatments will reduce rhinovirus infection in the natural setting remains to be determined.

Verran J, Packer A, Kelly P, et al. The retention of bacteria on hygienic surfaces presenting scratches of microbial dimensions. Lett Appl Microbiol. 2010;50(3):258-63. Epub 2009 Nov 30.

The aim of this study was to produce surfaces of defined linear topographical features which reflect those found on worn and new stainless steel, to monitor the effect of feature dimensions on the retention of *Listeria monocytogenes* and *Staphylococcus sciuri*. Surfaces were fabricated with parallel linear features of 30 microns or of microbial dimensions and used in microbial retention assays with *Staph. sciuri* and *L. monocytogenes*. Retained cells were distributed uniformly across the smooth 30 micron featured surfaces but were retained in high numbers on microtopographies at the 'peaks' between the wide grooves. On smaller features, retention was attributed to the maximum area of contact between cells and substratum being attained, with cocci being embedded in 1.02-microm-width grooves, and rods aligned along (and across) the densely packed parallel 0.59-microm grooves. The dimensions of surface features may enhance or impede cell retention. This phenomenon is also related to the size and shape of the microbial cell. These findings may help describe and evaluate properties of hygienic and easily cleanable surfaces.

Whitehead K, McCue KA. Virucidal efficacy of disinfectant actives against feline calicivirus, a surrogate for norovirus, in a short contact time. Am J Infect Control. 2010;38(1):26-30. Epub 2009 Jul 17.

The aim of this study was to determine the disinfectant actives and formulation factors necessary to achieve efficacy against norovirus in a short contact time. Feline calicivirus (FCV) was used as a surrogate for norovirus. In a carrier test method, common disinfectant actives including alcohol, acid, quaternary compound, and phenol both alone and as formulated disinfectants were contacted with dried FCV virus for 1 minute. The virus treatment was neutralised and assayed in Crandell-Reese kidney cells for cytopathic effect. The results led the investigators to conclude that acid cleaners, ethanol, and quaternary

compounds formulated at appropriate concentration and pH can be fast-acting antimicrobial choices and alternatives to bleach for consumer and healthcare providers to use to inactivate FCV, a surrogate for norovirus, and protect against this important pathogen.

Topic 4 – Intervention studies

Albert J, Luoto J, Levine D. End-User Preferences for and Performance of Competing POU Water Treatment Technologies among the Rural Poor of Kenya. Environ Sci Technol. 2010 May 6. [Epub ahead of print]

Household point-of-use (POU) water treatment technologies targeted at vulnerable populations are microbiologically effective and, in small trials, improve health. The factors that influence preference for and adoption of these technologies by target end-users are not fully understood. The investigators cycled 400 rural subsistence farm households in western Kenya through three randomly ordered two-month trials of three POU products: dilute hypochlorite solution, porous ceramic filtration, and a combined flocculant-disinfectant powdered mixture to compare relative end-user preferences and usage. Households reported higher usage of both dilute hypochlorite and filters than the flocculant-disinfectant. Averaged among all participating households, *Escherichia coli* reductions in treated water were generally higher among those that received dilute hypochlorite solution than among those receiving either of the other two products. Among those households that self-reported product usage, the *E. coli* reductions achieved by dilute hypochlorite and the flocculant-disinfectant are statistically equivalent to one another and higher than the reductions achieved by filters. At the same time, households ranked filters most frequently as their most preferred product.

Huq A, Yunus M, Salahuddin Sohel S, et al. Simple Sari Cloth Filtration of Water Is Sustainable and Continues To Protect Villagers from Cholera in Matlab, Bangladesh. mBio 2001 1(1): e00034-10.

A simple method for filtering water to reduce the incidence of cholera was tested in a field trial in Matlab, Bangladesh, and proved effective. A follow-up study was conducted 5 years later to determine whether the filtration method continued to be employed by villagers and its impact on the incidence of cholera. A total of 7,233 village women collecting water daily for their households in Bangladesh were selected from the same study population of the original field trial for interviewing. Analysis of the data showed that 31% of the women used a filter of which 60% used sari filters for household water. Results showed that sari filtration not only was accepted and sustained by the villagers and benefited them, including their neighbours not filtering water, in reducing the incidence of cholera, the latter being an unexpected benefit.

Sijbesma C, Christoffers T. The value of hygiene promotion: cost-effectiveness analysis of interventions in developing countries. Health Policy Plan. 2009;24(6):418-27. Epub 2009 Aug 24.

This article argues that objectively measured reductions of key sanitation and hygiene risks are better than DALYs for evaluating hygiene and sanitation promotion programmes. It presents a framework for the cost-effectiveness analysis of such programmes, which is used to analyse six field programmes. The conclusion drawn is that, if the promotion of good sanitation and hygiene is to receive the political and managerial support it deserves, every water, sanitation and/or hygiene programme should give data on inputs, costs, processes

and effects over time. More and better research that reflects the here-presented model is also needed to compare the cost-effectiveness of different promotional approaches.

Sroka S, Gastmeier P, Meyer E. Impact of alcohol hand-rub use on meticillin-resistant *Staphylococcus aureus*: an analysis of the literature. J Hosp Infect. 2010;74(3):204-11. Epub 2010 Jan 12.

The investigators aimed to evaluate the impact of alcohol hand disinfection with alcohol hand rub (AHR) as surrogate parameter of compliance or with compliance observations on the meticillin-resistant *Staphylococcus aureus* (MRSA) situation in hospital settings. Medline was searched for the keywords 'hand hygiene', 'compliance', 'disinfection', 'time series analysis' combined with 'meticillin-resistant *Staphylococcus aureus*/MRSA'. Data were included only from studies reporting exact numbers of AHR and/or compliance observations of MRSA situations over time. The literature search resulted in 272 hits, of which 12 studies met the inclusion criteria. The amount of AHR ranged between 3 and 78 mL/patient-day (pd) at the beginning and increased to 12 to 103 mL/pd at the end of the intervention studies. Compliance with hand disinfection ranged between 20% and 64% at the beginning and between 42% and 71% at the end. An increase in AHR correlated significantly with an improvement in the MRSA situation ($r=0.78$), whereas there was no such correlation between compliance and MRSA. An increased consumption of AHR was associated with a significant reduction of MRSA rates.

Pickering AJ, Boehm AB, Mwanjali M, et al. Efficacy of Waterless Hand Hygiene Compared with Handwashing with Soap: A Field Study in Dar es Salaam, Tanzania. Am J Trop Med Hyg. 2010;82(2):270-8.

Effective handwashing with soap requires reliable access to water supplies. However, more than three billion persons do not have household-level access to piped water. This research addresses the challenge of improving hand hygiene within water-constrained environments. The antimicrobial efficacy of alcohol-based hand sanitizer, a waterless hand hygiene product, was evaluated and compared with handwashing with soap and water in field conditions in Dar es Salaam, Tanzania. Hand sanitizer was significantly better than handwashing with respect to reduction in levels of faecal streptococci ($P = 0.01$). The feasibility and health impacts of promoting hand sanitiser as an alternative hand hygiene option for water-constrained environments should be assessed.

Abderrahmane S, Blatt S, Steinbrunner J, et al. Efficacy of a Targeted Bleach Cleaning Intervention to Reduce the Incidence of Endemic *Clostridium difficile*-Associated Diarrhea in a Multi-Hospital Healthcare System. 5th International conference on healthcare infections March 2010 poster number 146, Society for healthcare Epidemiology of infections. Friday, March 19, 2010. Grand Hall (Hyatt Regency Atlanta).

Clostridium difficile is the most common cause of hospital-associated diarrhoea. Contaminated hospital surfaces are a major source of transmission. Effective eradication of *C. difficile* spores from the hospital environment is one of the key interventions in controlling transmission. The purpose of this study was to evaluate the effectiveness of a targeted environmental cleaning programme using a bleach-based decontamination regimen in reducing the incidence of healthcare-associated *Clostridium difficile* colitis in a large multi-hospital healthcare system. The study results indicate that a bleach cleaning intervention programme may significantly reduce the incidence of new onset healthcare-associated *Clostridium difficile*-associated diarrhoea during the flu season, when antibiotic use in the hospital is highest.

Aiello AE, Coulborn RM, Aragon TJ, et al. Research findings from nonpharmaceutical intervention studies for pandemic influenza and current gaps in the research. Am J Infect Control. 2010;38(4):251-8. Epub 2010 Mar 12.

In June 2006, the Centers for Disease Control and Prevention released a request for applications to identify, improve, and evaluate the effectiveness of non-pharmaceutical interventions (NPIs)—strategies other than vaccines and antiviral medications – to mitigate the spread of pandemic influenza within communities and across international borders (RFA-CI06-010). These studies have provided major contributions to seasonal and pandemic influenza knowledge. Nonetheless, key concerns were identified related to the acceptability and protective efficacy of NPIs. Large-scale intervention studies conducted over multiple influenza epidemics, as well as smaller studies in controlled laboratory settings, are needed to address the gaps in the research on transmission and mitigation of influenza in the community setting. The current novel influenza A (H1N1) pandemic underscores the importance of influenza research.

Harris JP, Lopman BA, O'Brien SJ. Infection control measures for norovirus: a systematic review of outbreaks in semi-enclosed settings. J Hosp Infect. 2010;74(1):1-9. Epub 2009 Oct 12.

The researchers carried out a review of published, peer-reviewed articles to assess the evidence for effectiveness of control measures during norovirus outbreaks in enclosed settings. There were 47 papers identified for review, some of which reported more than one outbreak, providing 72 outbreaks for analysis. The researchers extracted the following data items: attack rates; the number of people affected and at risk, case or outbreak definition; whether outbreak control measures were implemented; and claims of effectiveness of interventions. They analysed the data to identify any differences in the outbreaks experienced in different settings and any differences experienced during outbreaks according to whether control measures were implemented or not. All of the reviewed papers described outbreaks occurring in industrialised countries. There was no evidence that implementing infection control measures affected the duration of outbreaks, or the attack rates either overall (all settings combined) or within particular settings. Sound infection control procedures are key to controlling norovirus outbreaks but unfortunately, the present body of the published literature does not provide an evidence-base for the value of specific measures.

Jefferson T, Del Mar C, Dooley L, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review. BMJ. 2009 Sep;339:b3675. doi: 10.1136/bmj.b3675.

The objective of this study was to review systematically the evidence of effectiveness of physical interventions to interrupt or reduce the spread of respiratory viruses. The data sources used were the Cochrane Library, Medline, OldMedline, Embase, and CINAHL, without restrictions on language or publication. Data selection: Studies of any intervention to prevent the transmission of respiratory viruses (isolation, quarantine, social distancing, barriers, personal protection, and hygiene). The study concludes that routine long-term implementation of some of the measures to interrupt or reduce the spread of respiratory viruses might be difficult. However, many simple and low cost interventions reduce the transmission of epidemic respiratory viruses. More resources should be invested into studying which physical interventions are the most effective, flexible, and cost effective means of minimising the impact of acute respiratory tract infections.

Topic 5 – Behaviour change

Forrester LA, Bryce EA, Mediaa AK. Clean Hands for Life: results of a large, multicentre, multifaceted, social marketing hand-hygiene campaign. J Hosp Infect. 2010;74(3):225-31. Epub 2010 Feb 12.

A year-long multifaceted hand-hygiene campaign entitled Clean Hands for Life targeting individual, environmental and organisational factors that influence healthcare worker (HCW) hand-hygiene behaviour was implemented in 36 acute and long-term care facilities in Vancouver Coastal Health region. The campaign involved rotation of ten novel posters, two poster contests, and distribution of multiple promotional items. A social marketing approach was used to implement and monitor the effectiveness of the campaign. Evaluation included quality assurance surveys, staff surveys (baseline, mid- and post-campaign), and focus groups. A total of 141 poster contest submissions was received, 5452 staff surveys completed and 14 focus groups conducted. The results showed that social marketing is an effective approach in engaging HCWs. Hand-hygiene campaigns that focus almost exclusively on increasing awareness among HCWs may not be as successful as multifaceted campaigns or campaigns that target identified barriers to hand-hygiene.

Judah G, Aunger R, Schmidt WP, et al. Experimental pretesting of hand-washing interventions in a natural setting. Am J Public Health. 2009;99 Suppl 2:S405-11.

The investigators pretested interventions derived from different domains of behavior change theory to determine their effectiveness at increasing handwashing with soap in a natural setting. They installed wireless devices in highway service station restrooms to record entry and soap use. Two text-only messages for each of 7 psychological domains were compared for their effect on soap-use rates. They collected data on nearly 200, 000 restroom uses. The knowledge activation domain was most effective for women, with a relative increase in soap use of 9.4% compared with the control condition. For men, disgust was the most effective, increasing soap use by 9.8%. Disgust was not significantly better than the control condition for women, nor was knowledge activation for men. Messages based on social norms and social status were effective for both genders.

Manning S, Barry T, Wilson N, et al. Update: Follow-up study showing post-pandemic decline in hand sanitiser use, New Zealand, December 2009. Euro Surveill. 2010;15(3). pii: 19466.

This study aimed to measure rates of hand sanitiser use in a hospital entrance foyer four months after a baseline study during New Zealand's influenza pandemic. Of the 743 people observed over one (summer) day in December 2009, 8.2% used the hand sanitiser, which was significantly lower ($p < 0.0001$) than the 18.0% reported in the August (winter) study. Health authorities may need to intensify promotion of hand hygiene to reduce the impact of future influenza pandemic waves.

Lau JT, Griffiths S, Choi KC, et al. Prevalence of preventive behaviors and associated factors during early phase of the H1N1 influenza epidemic. Am J Infect Control. 2010;38(5):374-80.

In this study, three rounds of random, population-based, anonymous telephone surveys were conducted in Hong Kong during the pre-community outbreak phase of the influenza A/H1N1 pandemic. Respectively, 46.65%, 88.75%, and 21.5% washed hands more than 10 times/day, wore face masks when having influenza-like illness (ILI), and wore face masks

regularly in public areas. Perceptions related to bodily damages, efficacy of frequent handwashing, nonavailability of effective vaccines, high chance of having a large scale local outbreak, and mental distress because of influenza A/H1N1 were associated with frequent handwashing. Perceived vaccine availability was associated with face mask use when having ILI. Perceived fatality, efficacy of wearing face masks, and mental distress because of influenza A/H1N1 were associated with face mask use in public areas. The investigators conclude that preventive behaviours were prevalently adopted by the public and were associated with cognitive and affective factors. Prevention efforts should take public perceptions into account, and emerging infectious diseases provide good chances for promoting hygiene.

Magiorakos AP, Leens E, Drouvot V, et al. Pathways to clean hands: highlights of successful hand hygiene implementation strategies in Europe. Euro Surveill. 2010;15(18). pii: 19560.

Hand hygiene is the most effective way to stop the spread of microorganisms and to prevent healthcare-associated infections (HAI). The World Health Organization launched the First Global Patient Safety Challenge – Clean Care is Safer Care – in 2005 with the goal to prevent HAI globally. This year, on 5 May, the WHO's initiative SAVE LIVES: Clean Your Hands, which focuses on increasing awareness of and improving compliance with hand hygiene practices, celebrated its second global day. In this article, four Member States of the European Union describe strategies that were implemented as part of their national hand hygiene campaigns and were found to be noteworthy. The strategies were: governmental support, the use of indicators for hand hygiene benchmarking, developing national surveillance systems for auditing alcohol-based hand rub consumption, ensuring seamless coordination of processes between health regions in countries with regionalised healthcare systems, implementing the WHO's My Five Moments for Hand Hygiene, and auditing of hand hygiene compliance.

Topic 6 – Microbial resistance

Kawamura-Sato K, Wachino JI, Kondo T, et al. Correlation between reduced susceptibility to disinfectants and multidrug resistance among clinical isolates of Acinetobacter species. J Antimicrob Chemother. 2010 Jun 24. [Epub ahead of print]

The aim of this study was to investigate the susceptibility profiles to disinfectants and antimicrobial agents of 283 non-repetitive Acinetobacter clinical isolates obtained in 97 Japanese hospitals in March 2002. Susceptibility profiles of the above isolates to four disinfectants, six antimicrobial agents and two dyes were investigated. The results of the study conclude that, since several Acinetobacter clinical isolates have developed augmented resistance to multiple antimicrobials and disinfectants, it is worth checking the susceptibility to disinfectants if multidrug-resistant Acinetobacter spp. are recurrently isolated clinically.

Mc Cay PH, Ocampo-Sosa AA, Fleming GT. Effect of subinhibitory concentrations of benzalkonium chloride on the competitiveness of Pseudomonas aeruginosa grown in continuous culture. Microbiology. 2010;156(1):30-8. Epub 2009 Oct 8.

This study investigates the link between adaptation to biocides and antibiotics in Pseudomonas aeruginosa. The results indicate the importance of environmental conditions on selection and maintenance of biocide adaptation.

Svetlíková Z, Skovierová H, Niederweis M, et al. Role of porins in the susceptibility of *Mycobacterium smegmatis* and *Mycobacterium chelonae* to aldehyde-based disinfectants and drugs. *Antimicrob Agents Chemother.* 2009;53(9):4015-8. Epub 2009 Jul 6.

Nosocomial outbreaks attributable to glutaraldehyde-resistant, rapidly growing mycobacteria are increasing. Here, evidence is provided that defects in porin expression dramatically increase the resistance of *Mycobacterium smegmatis* and *Mycobacterium chelonae* to glutaraldehyde and another aldehyde disinfectant, ortho-phthalaldehyde. Since defects in porin activity also dramatically increased the resistance of *M. chelonae* to drugs, there is thus some concern that the widespread use of glutaraldehyde and ortho-phthalaldehyde in clinical settings may select for drug-resistant bacteria.

Topic 7 – Hygiene hypothesis

Eden T. Aetiology of childhood leukaemia. *Cancer Treat Rev.* 2010 Mar 9. [Epub ahead of print]

The acute leukaemias account for about 30% of all malignancy seen in childhood across the Western world. A peak incidence of precursor B cell ALL has emerged as socio-economic conditions have improved in countries worldwide. From twin studies and the use of neonatal blood spots it has been possible to back track the first initiating genetic events within critical haemopoietic cells to foetal development in utero for most precursor B cell ALL and some cases of AML. These events may occur as part of normal foetal development. Whether other factors (environmental or constitutional) are involved to increase the chance of these first genetic changes happening is unclear. This article contains clear echoes of the "hygiene hypothesis" regarding the initiation of allergies, autoimmune disease and type I diabetes mellitus in children and young people.

Jackson DJ, Johnston SL. The role of viruses in acute exacerbations of asthma. *J Allergy Clin Immunol.* 2010;125(6):1178-87; quiz 1188-9.

Viral respiratory infections are the most common cause of an acute asthma exacerbation in both children and adults and represent a significant global health burden. An increasing body of evidence supports the hypothesis that these infections cause a greater degree of morbidity in asthmatic subjects than in the healthy population, emphasising a discrepancy in the antiviral response of asthmatics. In this review the investigators discuss why such a discrepancy might exist, examining the role of the bronchial epithelium as well as the main inflammatory cells, mediators, and molecular pathways that are involved in the immune response. In addition, the potential impact of virus-induced asthma exacerbations on airway remodelling is reviewed and they explore which therapeutic options might be of benefit in preventing the deterioration of asthma control seen following viral infection.

Severson KM, Mallozzi M, Driks A, et al. B cell development in GALT: role of bacterial superantigen-like molecules. *J Immunol.* 2010;184(12):6782-9. Epub 2010 May 7.

Intestinal bacteria drive the formation of lymphoid tissues, and in rabbit, bacteria also promote development of the pre-immune Ab repertoire and positive selection of B cells in GALT. Previous studies indicated that *Bacillus subtilis* promotes B cell follicle formation in GALT, and this study investigated the mechanism by which *B. subtilis* stimulates B cells. The researchers found that spores of *B. subtilis* and other *Bacillus* species, including *Bacillus anthracis*, bound rabbit IgM through an unconventional, superantigen-like binding site, and in

vivo, surface molecules of *B. anthracis* spores promoted GALT development. The study provides direct evidence that B cell development in GALT may be driven by superantigen-like molecules, and furthermore, that bacterial spores modulate host immunity.

Maier RM, Palmer MW, Andersen GL, et al. Environmental determinants of and impact on childhood asthma by the bacterial community in household dust. *Appl Environ Microbiol.* 2010;76(8):2663-7. Epub 2010 Feb 12.

Asthma increased dramatically in the last decades of the 20th century and is representative of chronic diseases that have been linked to altered microbial exposure and immune responses. This study evaluates the effects of environmental exposures typically associated with asthma protection or risk on the microbial community structure of household dust (dogs, cats, and day care). PCR-denaturing gradient gel analysis (PCR-DGGE) demonstrated that the bacterial community structure in house dust is significantly impacted by the presence of dogs or cats in the home, and by whether or not children attend day care. In addition, significant differences in the dust bacterial community were associated with asthma outcomes in young children, including wheezing and specific IgE. The findings suggest that specific bacterial populations within the community are associated with either risk or protection from asthma.

Mosconi E, Rekima A, Seitz-Polski B, et al. Breast milk immune complexes are potent inducers of oral tolerance in neonates and prevent asthma development. *Mucosal Immunol.* 2010 May 19. [Epub ahead of print]

In this study the researchers find that breastfeeding by antigen-sensitised mothers exposed to antigen aerosols during lactation induced a robust and long-lasting antigen-specific protection from asthma. Protection was more profound and persistent than the one induced by antigen-exposed non-sensitised mothers. The study provides new insights on the mechanisms of tolerance induction in neonates and highlights that IgG immune complexes found in breast milk are potent inducers of oral tolerance. These observations may pave the way for the identification of key factors for primary prevention of immune-mediated diseases such as asthma.

Schmitt J, Schmitt NM, Kirch W, et al. Early exposure to antibiotics and infections and the incidence of atopic eczema: a population-based cohort study. *Pediatr Allergy Immunol.* 2010;21(2 Pt 1):292-300. Epub 2009 Aug 27.

This study describes the complex relationship between early exposure to infections, anti-infectious treatment with antibiotics, and incident AE. Using a German population-based administrative healthcare and prescription database, a cohort of 370 children not diagnosed as having AE during their first year of life was established. For each individual child all infections and prescriptions of antibiotics within the first year as well as incident AE within the second year of life were identified. Crude analyses suggested that early infections and exposure to antibiotics are risk factors for AE. However, stratified analyses indicated that early infections were only associated with a higher rate of AE when treated with broad-spectrum antibiotics such as cephalosporines or macrolides. The results for other common childhood infections tended to be similar. Antibiotic treatment appears to modify the association between early infections and subsequent AE. The study found no evidence that infections per se significantly alter the likelihood for subsequent AE.

Sordillo JE, Hoffman EB, Celedón JC, et al. Multiple microbial exposures in the home may protect against asthma or allergy in childhood. Clin Exp Allergy. 2010;40(6):902-10 Published Online: 13 Apr 2010

The objective of this study was to determine the influence of current GNB and GPB exposures on asthma and allergic sensitisation in school-aged children. The investigators examined the relationship between bacterial biomarkers and current asthma and allergic sensitisation in 377 school-aged children in a birth cohort study. They then evaluated the effects of school-aged endotoxin, after controlling for exposure in early life. The results indicate that exposure to GNB is inversely associated with asthma and allergic sensitisation at school age. In contrast, elevated GPB in the bed was inversely associated with current asthma, but not with allergic sensitisation. School-aged endotoxin exposure remained protective in models for allergic disease adjusted for early-life endotoxin. Both GNB and GPB exposures are associated with decreased asthma symptoms, but may act through different mechanisms to confer protection. Endotoxin exposure in later childhood is not simply a surrogate of early-life exposure; it has independent protective effects on allergic disease.

Topic 8 – Safety

Hahn S, Schneider K, Gartiser S, et al. Consumer exposure to biocides--identification of relevant sources and evaluation of possible health effects. Environ Health. 2010;9:7.

Products containing biocides are used for a variety of purposes in the home environment. To assess potential health risks, data on products containing biocides were gathered by means of a market survey, exposures were estimated using a worst case scenario approach (screening), the hazard of the active components were evaluated, and a preliminary risk assessment was conducted. Numerous consumer products were found to contain biocides. However, it appeared that only a limited number of biocidal active substances or groups of biocidal active substances were being used. The study results led to the conclusion that exposure to biocides from household products may contribute to induction of sensitisation in the population. The use of biocides in consumer products should be carefully evaluated. Detailed risk assessments will become available within the framework of the EU Biocides Directive.

Litvinov IV, Sugathan P, Cohen BA. Recognizing and Treating Toilet-Seat Contact Dermatitis in Children. Pediatrics. 2010;125(2):e419-e422 (doi:10.1542/peds.2009-2430)

Toilet-seat contact dermatitis is a common condition around the world and is reemerging in the United States. It can be easily recognised and treated. However, few practitioners consider this diagnosis, which results in a delay in treatment and often exacerbation of the skin eruption. In the past, exposure to wooden toilet seats and associated varnish, lacquers, and paints led to the development of an allergic contact dermatitis on the buttocks and posterior thighs. In recent years, most public facilities have changed to plastic seats, resulting in a change in the clinical presentation of toilet-seat dermatitis. This study presents 5 cases of toilet-seat dermatitis in children from the United States and India and reviews the history, presentation, and clinical course of the disease. The findings suggest that toilet-seat dermatitis is more common than previously recognised and should be considered in any child with a dermatitis that involves the buttocks and posterior thighs.

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