



### **IFH – Another year**

In November 2009, IFH completed its 12<sup>th</sup> year of operation. One of our initiatives this year has been to update our original 1997 keynote review. From this review of the evidence, the IFH Scientific Board concluded “Epidemiological and microbiological data suggest an *a priori* need for an improvement in hygiene awareness and hygiene practices in the home”. Our new 2009 paper entitled “The global burden of hygiene-related diseases in relation to the home and community” shows clearly that, since 1997, there have been significant changes, which indicate that the need to address the issue of home and community hygiene is increasing rather than decreasing.

In 2009 we also completed the migration of the IFH website to the City University. This means that, although we retain our status as an independent site, we also become part of the family of UK sites which includes the National Electronic Library on Infection (NELI) and the National Resource on Infection Control (NRIC). The migration allowed us to update the site to better meet the needs of our users. We also introduced a new area to our website which contains a comprehensive set of fact and advice sheets. This is in response to the demand for more information in “plain language”. The fact/advice sheets cover topics which range from individual organisms, to different aspects of hygiene, to hygiene issues such as the hygiene hypothesis and antibiotic resistance. The webstats suggest that our site attracts more than 3,500 visitors a month, and a total of more than 11,000 page views. In 2010 we aim to develop initiatives which will ensure that, as far as possible, our online materials reach those who are seeking information about hygiene in home and everyday life.

### **Use of ash and mud for handwashing in low income communities – a new review from IFH**

In low income communities, handwashing is particularly important in reducing the burden of infectious and parasitic diseases. The data suggest however that the efficacy of the handwashing process itself has a significant impact on the risk of disease transmission. A key factor is the extent to which pathogens are detached from the skin surface, by rubbing with appropriate materials prior to rinsing. In low income communities, soil, mud or ash are still frequently used as an alternative to soap. In using mud, soil or ash as an alternative to soap, it is important to weigh the potential benefits, against the fact that these materials can become contaminated with pathogens and helminths, and can themselves act as a vehicle and source of gastrointestinal, parasitic and other infections. These materials can also contain potential toxic heavy metals such as arsenic, lead and chromium, as well as pesticides. The objective of this review is to bring together the available scientific data on the benefits and potential risks of using mud, soil and ash, as against soap and as against water only, for handwashing, and evaluate the factors which inform choice of the most appropriate agent in relation to the needs and constraints in different communities.

The review was prepared by Professor Sally Bloomfield and Professor KJ Nath and is available from: <http://www.ifh-homehygiene.org/IntegratedCRD.nsf/eb85eb9d8ecd365280257545005e8966/9ae568b43e25c9258025764f004bae1c?OpenDocument>

### **e-Bug, a pan-European educational resource for schools - update Spring 2010**

The aim of the e-Bug project is to disseminate a school antibiotic and hygiene education pack across Europe. The project is lead by the Health Protection Agency (HPA) Primary Care Unit in Gloucester, UK and involves a consortium of 18 partner EU countries. During 2009 each of the 10 associate partner countries translated the pack and website. Packs were printed and distributed free to schools in these countries. All the pack materials, videos of the activities and extension activities are now available on the e-Bug



website in the ten languages. The project was 60% funded by DG Sanco until the end of 2009. The e-Bug website and project management will be supported by the HPA England from April 2010. The European Centre for Disease Prevention and Control (ECDC) has included translation of the e-Bug resources into the other EU languages, and an implementation meeting, as part of their 2010 European Antibiotic Awareness Day proposals. Countries will then implement the resources in their schools so that e-Bug can be disseminated right across Europe.

**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](mailto:clodna.mcnulty@hpa.org.uk)) or Dr Donna Lecky ([donna.lecky@hpa.org.uk](mailto: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.

### **Effectiveness of common household cleaning agents in reducing the viability of human influenza A/H1N1 – are we getting confused?**

The UK HPA have reported a study of a range of “common household cleaning agents” for their effectiveness at killing or reducing the viability of influenza A virus. The test method used was the Standard Suspension test (BS:EN 14476:2005) for evaluation of virucidal activity. They found that agents such as 1% bleach, 10% malt vinegar, or 0.01% washing-up liquid rapidly and completely inactivated the flu virus. 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-flu activity. The authors concluded that, in the context of the ongoing pandemic, especially in low-resource settings, the public does not need to source “specialized cleaning products”, but can rapidly disinfect potentially contaminated surfaces with agents readily available in most homes. The UK HPA on line advice to the public on preventing the spread of influenza is to “wash hands frequently”, and “use normal cleaning products” for treating surfaces such as hand contact surfaces. How are the public supposed to know the difference between “normal cleaning, disinfecting and antibacterial products” and products which are not normal. We urgently need to agree some consistent terminology to ensure that the public have clear advice. The full paper can be found at PLoS One. 2010 Feb 1;5(2):e8987.

### **The role of environmental cleaning in the control of hospital-acquired infection – a review by Dr Stephanie Dancer**

At a conference hosted by the *Lancet* in Dec 2008, Dr Stephanie Dancer presented a review of the role of environmental cleaning in the control of hospital-acquired infection which is now published in the *Journal of Hospital Infection* (2009; 73, 378-385). At present, the precise role of environmental cleaning in the control of these organisms remains unknown. Stephanie believes that, until cleaning becomes an evidence-based science, with established methods for assessment, the importance of a clean environment is likely to remain speculative. This review examines the links between the hospital environment and various pathogens, including MRSA, VRE, norovirus, *C. difficile* and *acinetobacter*. One of Stephanie’s concerns is that cleaning is often delivered as part of an overall control package in response to an outbreak and the importance of cleaning as a single intervention remains controversial. Recent work has shown that hand-touch sites are habitually contaminated by hospital pathogens, which are then delivered to patients on hands. She proposes that targeted cleaning of these sites may offer a useful adjunct to the current preoccupation with hand hygiene, but the hand-touch side of the equation needs more study. The review concludes with 3 thought-provoking sections entitled “What is clean?” “Where to clean” and “How to clean”.

### **Community-associated methicillin-resistant *Staphylococcus aureus* as a cause of hospital-acquired infections**

From a review of the literature Skov and Jensen (R.L. Skov, K.S. Jensen, *Journal of Hospital Infection* (2009) 73, 364-370) conclude that the distinction between CA-MRSA and HA-MRSA is becoming increasingly blurred. In the UK, HA-MRSA still dominates. However, in other countries

such as Greece and the USA and low-level countries like Denmark, CA-MRSA causes a significant portion of HAIs. Reports from several countries document that CA-MRSA is spreading from closed risk communities into the general population. Mathematical modelling reported in this review suggests that transmission of MRSA in the community influences the occurrence of MRSA and thereby of HAI in hospitals significantly. The authors conclude that CA-MRSA is a matter of serious concern and should be suppressed.

### **Mission possible – evaluation report of a UK food hygiene promotion campaign**

The UK Food Standards Agency has published an evaluation report of “Mission: Possible!” a UK-wide pilot scheme aimed at teaching food hygiene messages to children aged 8 to 10 (key stage 2).

The report is available from: <http://www.food.gov.uk/news/newsarchive/2009/oct/mpeval>

### **Isolation of MRSA and other bacteria of medical interest on commonly touched household surfaces**

Elizabeth Scott and co-workers carried out a study to characterise and quantify bacteria of medical interest on commonly touched household surfaces and evaluate predictors such as employment, day care attendance, and presence of infants and pets (AJIC 2008, 36: 447-453). A sample of 35 homes were recruited from the metro-Boston area, and up to 32 surfaces were sampled in kitchens, bathrooms, and living areas. Highest bacterial counts were associated with wet sites including hand/skin contact surfaces such as the tub, kitchen sink, and faucet handles. Surfaces were found to be contaminated with species of *Enterobacteriaceae*, *Pseudomonas*, methicillin-sensitive *S. aureus* (MSSA), and MRSA. The presence of a cat in the home was found to be a strong predictor for the isolation of MRSA. The authors conclude that this study provides further evidence that “cleaning in homes should be directed to the areas pinpointed by the study as very rich in bacteria of potential medical importance”.

### **ECDC publishes the Annual Epidemiological Report 2009**

The third annual report on the epidemiology of 47 communicable diseases and two health issues across the European Union and European Economic Area has been published. The result of a collective effort by 30 countries, it presents a comprehensive overview of the data from 2007 in standard tables and graphs, together with an analysis of the health threats monitored by ECDC during 2008. By collating data from across Europe, the Annual Epidemiological Report provides an annual picture of the state of infectious diseases in Europe which supports public health policymakers in making informed decisions and prioritising action to improve the health of all Europeans.

The report can be obtained from: [http://www.ecdc.europa.eu/en/publications/Publications/0910\\_SUR\\_Annual\\_Epidemiological\\_Report\\_on\\_Communicable\\_Diseases\\_in\\_Europe.pdf](http://www.ecdc.europa.eu/en/publications/Publications/0910_SUR_Annual_Epidemiological_Report_on_Communicable_Diseases_in_Europe.pdf)

### **New WHO report gives 7-point plan to reduce the 1.5 million child deaths globally caused by diarrhoea**

A new report released by UNICEF and WHO provides a plan for comprehensive diarrhoea control. The 7-point plan is made up of two treatment and five prevention strategies. For treatment, children need fluid replacement to prevent dehydration, and zinc supplements. Oral rehydration therapy is the cornerstone of fluid replacement, and the gold standard is low-osmolarity oral rehydration solution. Important additional components include continued feeding, including breastfeeding, and use of appropriate fluids in the home if oral rehydration solution is not available, along with increased fluids in general. The prevention package consists of: i) Rotavirus and measles vaccinations; ii) Promotion of early and exclusive breastfeeding and vitamin A supplementation; iii) Promotion of handwashing with soap; iv) Improvement of water quantity and quality, including treatment and safe storage of household water; and v) Promotion of community-wide sanitation. Vaccination against rotavirus, which causes 40% of hospital admissions from diarrhoea in children under 5 worldwide, has recently been recommended for inclusion in all national immunisation programmes. The authors conclude: “We know what works

to reduce child deaths from diarrhoea and what actions will make a lasting reduction in the burden of diarrhoea. We need to make the prevention and treatment of diarrhoea everybody's business, from families and communities to government leaders to the global community."

The report is available from: [http://www.who.int/child\\_adolescent\\_health/documents/9789241598415/en/index.html](http://www.who.int/child_adolescent_health/documents/9789241598415/en/index.html)

### **Tackling global health risks prevents premature deaths**

According to a new WHO report, global life expectancy could be increased by nearly 5 years by addressing 5 factors affecting health – childhood underweight, unsafe sex, alcohol use, lack of safe water, sanitation and hygiene, and high blood pressure. These are responsible for one-quarter of the 60 million deaths estimated to occur annually. The report describes 24 factors affecting health. These are a mixture of environmental, behavioural and physiological factors, such as air pollution, tobacco use and poor nutrition. Many deaths and diseases are caused by more than one risk factor and may be prevented by reducing any of the risk factors responsible for them. The WHO says "Understanding the relative importance of health risk factors helps governments to figure out which health policies they want to pursue"

The report is available from: [http://www.who.int/mediacentre/news/releases/2009/health\\_risks\\_report\\_20091027/en/index.html](http://www.who.int/mediacentre/news/releases/2009/health_risks_report_20091027/en/index.html)

### **Household water treatment and safe storage '09**

A meeting of the Household Water Treatment and Safe Storage Network took place in Dublin, Ireland, 21-23 September 2009. The meeting addressed barriers in introducing, scaling-up and achieving sustainable household water treatment and safe storage. The Conference programme was, in part, dedicated to the WHO-hosted HWTS Network.

Presentations can be found at: <http://events.rcsi.ie/ei/cm.esp?id=57&pageid=2M90ZCG2Y>

### **Everyday germs in childhood may prevent diseases in adulthood**

Research by Mcdade and co-workers suggests that lack of exposure to common everyday bacteria and microbes early in life may contribute to higher levels of inflammation as an adult, which in turn increases risks for a wide range of diseases, including cardiovascular diseases. The research took advantage of a longitudinal study of Filipinos, following participants *in utero* through 22 years of age, to get a better understanding of how environments early in life affect production of C-reactive protein (CRP) production in adulthood. Levels of the protein rise in the blood due to inflammation, an integral part of the immune system's fight against infection. CRP research has mostly centred on the protein as a predictor of heart disease. Blood tests showed that C-reactive protein was at least 80 percent lower for study participants in the Philippines when they reached young adulthood, relative to their American counterparts, though the Filipinos suffered from many more infectious diseases as infants and toddlers.

The full paper can be found at: <http://rspb.royalsocietypublishing.org/content/early/2009/12/08/rspb.2009.1795.full.pdf+html>

### **Staphylococci on the skin surface can regulate the immune system and regulate over-active immune responses - a molecular basis to understand the hygiene hypothesis?**

Researchers from the School of Medicine at the University of California, San Diego, found that some non-harmful bacteria that live on the skin play an important role in regulating inflammation and preventing overactive immune responses. Researchers found that *Staphylococci* block a vital step in a cascade of events that led to inflammation. By studying mice and human cells, they found the harmless bacteria did this by making lipoteichoic acid (LTA), which acted on keratinocytes, the main cell types found in the outer layer of the skin. The LTA keeps the keratinocytes in check, stopping them from mounting an aggressive inflammatory response. Head of the research, Professor Richard Gallo said: "The exciting implication of the work is that it provides a molecular basis to understand the hygiene hypothesis".

The research is published in *Nature Medicine* 15, 1377 - 1382 (2009).

### **The hygiene hypothesis – do we still believe it?**

A number of useful review/commentary papers have been published this year which summarise the ongoing debate about the hygiene hypothesis. Douwes and Pearce review a number of important pieces of evidence namely the high asthma prevalence in Latin America (which appears unlikely to have lower infection rates than Europe) and the decline in asthma prevalence in both adults and children in Western countries (which are unlikely to have become “less clean” in recent decades). The basic message is that the hygiene hypothesis, particularly in its original form, does not explain by itself the changes in the prevalence of asthma (mostly) and atopic disease more generally. For asthma, one confounding factor is the proportion of non-allergic asthma (which accounts for more than 50%), which clearly would not be influenced by microbial exposure. For atopic disease more generally, the conclusion is that the hygiene hypothesis in its later manifestations can provide some mechanistic explanation for changing trends in prevalence, but that atopic disease is a multifactorial disease with many different elements modulating its development. Furthermore, it is almost certain that these different elements vary in their influence with the environment in which they occur.

In a further paper Bjorksten concludes that although numerous epidemiological studies suggest that there is an inverse relationship between allergic diseases and infections in early childhood, there are also several well-conducted epidemiological studies that seemingly contradict this relationship. He further concludes that epidemiological, clinical and animal studies taken together suggest that broad exposure to a wealth of commensal, non-pathogenic microorganisms early in life are associated with protection, not only against IgE-mediated allergies, but also conceivably against type-1 diabetes and inflammatory bowel disease. He says “This has little relationship with 'hygiene' in the usual meaning of the word. The term 'hygiene hypothesis' is unfortunate, as it is misleading. A better term would be 'microbial deprivation hypothesis'.”

The papers can be found at:

- Douwes J, Pearce N. Commentary: The end of the hygiene hypothesis? *International Journal of Epidemiology* 2008;37:570-572
- Linneberg A Hygiene hypothesis: wanted – dead or alive *International Journal of Epidemiology* 2008; Dec 9<sup>th</sup> 2008:1-2
- Jeroen Douwes\* and Neil Pearce Hygiene hypothesis: wanted – dead or alive *International Journal of Epidemiology* 2008; Dec 9<sup>th</sup> 2008
- Bjorkstén B.The Hygiene Hypothesis: Do We Still Believe in It? *Nestle Nutr Workshop Ser Pediatr Program.* 2009;64:11-22. Epub 2009 Aug 19.

### **Enhanced cleaning of near patient handtouch sites can reduce MRSA infections in hospital patients**

Stephanie Dancer and co-workers have studied the impact of one additional cleaner on hospital wards. Enhanced cleaning was associated with a 32.5% reduction in levels of microbial contamination at handtouch sites when wards received enhanced cleaning. Near-patient sites (lockers, overbed tables and beds) were more frequently contaminated with MRSA/*S. aureus* than sites further from the patient. Genotyping identified indistinguishable strains from handtouch sites and patients, supporting the possibility that patients acquired MRSA from environmental sources. There was a 26.6% reduction in new MRSA infections on the wards receiving extra cleaning, despite higher MRSA patient-days and bed occupancy rates during enhanced cleaning periods. Adjusting for MRSA patient-days and based upon nine new MRSA infections seen during routine cleaning, they expected 13 new infections during enhanced cleaning periods rather than the four that actually occurred. Clusters of new MRSA infections were identified 2 to 4 weeks after the cleaner left both wards. It was estimated that enhanced cleaning saved the hospital £30,000 to £70,000.

The report can be found at *BMC Medicine* 2009, 7:28 doi:10.1186/1741-7015-7-28.

## LIBRARY OF RECENT PUBLICATIONS

### Topic 1: Infectious disease Incidence

#### **Noroviruses in healthcare settings: a challenging problem. Koopmans M.**

This is a review of the epidemiology, clinical impact and infection control issues relating to norovirus infection outbreaks in hospitals. J Hosp Infect. 2009 Dec;73(4):331-7. Epub 2009 Sep 22.

#### **Extended-spectrum beta-lactamase-producing organisms. Falagas ME, Karageorgopoulos DE.**

This is a review of mainly about ESBL infections in hospitals. Community-acquired ESBL-associated infections typically affect patients with various complicating factors. A relevant case :control study identified various risk factors for community-acquired infection by ESBL-producing *E. coli*, including increased age, female sex, diabetes mellitus, recurrent urinary tract infection, previous instrumentation of the urinary tract, follow-up in outpatient clinic, and previous receipt of aminopenicillins, cephalosporins, or fluoroquinolones. Such findings raise the question whether community- onset ESBL-associated infections are mainly healthcare-associated. However, reports of truly community-acquired infections are increasing, while clusters of cases in the community, particularly among members of the same family, may be observed. J Hosp Infect. 2009 Dec;73(4):345-54. Epub 2009 Jul 10.

#### **Community-associated meticillin-resistant *Staphylococcus aureus* as a cause of hospital-acquired infections. Skov RL, Jensen KS.**

From a review of the literature the authors conclude that the distinction between CA-MRSA and HA-MRSA is becoming increasingly blurred In the UK, HA-MRSA still dominates. However, in other countries such as Greece and USA and low-level countries like Denmark, CAMRSA causes a significant portion of HAIs. Reports from several countries document that CA-MRSA is spreading from closed risk communities into the general population. Mathematical modelling suggests that transmission of MRSA in the community influences the occurrence of MRSA and thereby of HAI in hospitals significantly. CA-MRSA is thus a matter of serious concern and should be suppressed. J Hosp Infect. 2009 Dec;73(4):364-70. Epub 2009 Sep 27.

#### **Influenza as a trigger for acute myocardial infarction or death from cardiovascular disease: a systematic review. Warren-Gash C, Smeeth L, Hayward AC.**

Cardiac complications of influenza infection, such as myocarditis, are well recognised, but the role of influenza as a trigger of acute myocardial infarction is less clear. The authors conducted a systematic review of the evidence that influenza (including influenza-like illness and acute respiratory infection) triggers acute myocardial infarction or cardiovascular death. They examined the effectiveness of influenza vaccines at protecting against cardiac events and did a meta-analysis of data from randomised controlled trials. The results lead them to believe that influenza vaccination should be encouraged wherever indicated, especially in people with existing cardiovascular disease, among whom there is often suboptimum vaccine uptake. Further evidence is needed on the effectiveness of influenza vaccines to reduce the risk of cardiac events in people without established vascular disease. Lancet Infect Dis. 2009;9(10):601-10.

#### **Early origins of inflammation: microbial exposures in infancy predict lower levels of C-reactive protein in adulthood. McDade TW, Rutherford J, Adair L, Kuzawa CW.**

Ecological factors are important determinants of the development and function of anti-pathogen defences. Inflammation is a central part of innate immunity, but the developmental factors that shape the regulation of inflammation are not known. The authors test the hypothesis that microbial exposures in infancy are associated with high sensitivity C-reactive protein (CRP) in adulthood using prospective data from a birth cohort in the Philippines (n ¼ 1461). Proc Biol Sci. [Epub ahead of print]

### Topic 2: Infection Transmission in the home

#### **Isolation of methicillin-resistant *Staphylococcus aureus* (MRSA) from rented DVDs. Ghenghesh KS, Nashnoush H, Shaker A, Enaami H, Zorgani A.**

Of 60 DVDs evaluated in this study, *Staphylococcus aureus* was detected on 35 (58.3%), *S. epidermidis* on 20 (33.3%), *Pseudomonas aeruginosa* on 3 (5%), gram-negative rods on 7 (11.7%), gram-negative cocci on 1 (1.7%), and *Bacillus* species on 23 (38.3%). No Enterobacteriaceae, Streptococcus, or Aeromonas species were detected. Of the *S. aureus* isolates detected on the rented DVDs, 4 (11.4%) were found to be resistant to oxacillin—that is MRSA. Am J Infect Control. 2009 Sep;37(7):612.

#### **A critical evaluation of methicillin resistant *Staphylococcus aureus* and other bacteria of medical interest on commonly touched household surfaces in relation to household demographics. Scott E, Duty S, McCue K.**

A convenience sample of 35 homes was recruited from the metro-Boston area, and up to 32 surfaces were sampled in kitchens, bathrooms, and living areas. Highest bacterial counts were associated with wet

sites including hand/skin contact surfaces such as the tub, kitchen sink, and faucet handles. Surfaces were found to be contaminated including species of *Enterobacteriaceae*, *Pseudomonas*, methicillin-sensitive *S. aureus* (MSSA), and MRSA. A number of hand/skin contact surfaces were found to be frequently contaminated with one or more of the bacteria. The presence of a cat in the home was found to be a strong predictor for the isolation of MRSA. *Am J Infect Control*. 2009 Aug;37(6):447-53. Epub 2009 Apr 9.

***Pseudomonas aeruginosa*: a formidable and ever-present adversary. Kerr KG, Snelling AM.**

Management of infections is difficult as *P. aeruginosa* is inherently resistant to many antimicrobials. Furthermore, treatment is increasingly problematic due to the emergence and spread of resistance. Given these challenges, it seems reasonable to identify strategies that would prevent acquisition by hospitalised patients. Environmental reservoirs of *P. aeruginosa* are readily identifiable, and there are numerous reports of outbreaks that have been attributed to an environmental source. There is emerging evidence from prospective studies to suggest that environmental sources, especially water, may have significance in the epidemiology of sporadic *P. aeruginosa* infections in hospital settings. A better understanding of the role of environmental reservoirs in pseudomonal infection will permit the development of new strategies and refinement of existing approaches to interrupt transmission from these sources to patients. *J Hosp Infect*. 2009 Dec;73(4):338-44. Epub 2009 Aug 21.

**Relative Contributions of Four Exposure Pathways to Influenza Infection Risk. Nicas M, Jones RM.**

The relative contribution of 4 influenza virus exposure pathways (1) virus-contaminated hand contact with facial membranes, (2) inhalation of respirable cough particles, (3) inhalation of cough particles, and (4) spray of cough droplets onto facial membranes must be quantified to determine the potential efficacy of nonpharmaceutical interventions of transmission. This paper describes use of a mathematical model to estimate the relative contributions of the 4 pathways to infection risk. The authors conclude that, given the sparse knowledge concerning influenza dose and infectivity via different exposure pathways, interventions for influenza should simultaneously address potential exposure via hand contact and droplet spray. *Risk Anal*. 2009 Sep;29(9):1292-303. Epub 2009 Jun 24.

**Community-associated methicillin-resistant *Staphylococcus aureus*: epidemiology, microbiology and clinical impact in East Yorkshire, UK. Elston JW, Meigh J, Kearns AM, Jordan-Owers N, Newton A, Meigh RE, Barlow G.**

The prevalence of community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) is increasing worldwide. Whilst CA-MRSA has been reported in the UK, there is little information concerning its clinical impact. This study reports on three epidemic lineages of CA-MRSA occurring in East Yorkshire and describes their epidemiology, microbiology and clinical impact. *J Hosp Infect*. 2009;72(4):307-13. Epub 2009 Jul 10.

**Opportunistic pathogens enriched in showerhead biofilms. Feazel LM, Baumgartner LK, Peterson KL, Frank DN, Harris JK, Pace NR.**

The environments that humans encounter daily are sources of exposure to diverse microbial communities, some of potential concern to human health. In this study, the researchers used culture-independent technology to investigate the microbial composition of biofilms inside showerheads as ecological assemblages in the human indoor environment. Showers are an important interface for human interaction with microbes through inhalation of aerosols, and showerhead waters have been implicated in disease. Although opportunistic pathogens commonly are cultured from shower facilities, there is little knowledge of either their prevalence or the nature of other microorganisms that may be delivered during shower usage. *Proc Natl Acad Sci U S A*. 2009;106(38):16393-9. Epub 2009 Sep 14.

**Microbial contamination of computer keyboards in a university setting. Anderson G, Palombo EA.**

The keyboards of multiple-user (student) and single-user (staff) computers located on a university campus were sampled to assess microbial contamination. The average number of microorganisms present on multiple-user computer keyboards was significantly greater than on single-user keyboards, and the number of keyboards harbouring potential pathogens was also greater for multiple-user computers. It is recommended that regular cleaning and disinfection of computers be used to reduce the microbial load, especially for multiple-user workstations. *Am J Infect Control*. 2009;37(6):507-9. Epub 2009 Feb 23.

**Hand-mouth transfer and potential for exposure to *E. coli* and F+ coliphage in beach sand, Chicago, Illinois. Whitman RL, Przybyla-Kelly K, Shively DA, Nevers MB, Byappanahalli MN.**

Beach sand contains faecal indicator bacteria, often in densities greatly exceeding the adjacent swimming waters. The authors examine the transferability of *Escherichia coli* and F+ coliphage (MS2) from beach sand to hands in order to estimate the potential subsequent health risk. The results suggest that beach sand may be an important medium for microbial exposure; bacteria transfer is related to initial concentration in the sand; and rinsing may be effective in limiting oral exposure to sand-borne microbes of human concern. *J Water Health*. 2009;7(4):623-9.

**Staphylococcus aureus recovery from cotton towels. Oller AR, Mitchell A.**

Staphylococcus aureus is an emerging pathogen afflicting healthy individuals without known risk factors, and methicillin-resistant Staphylococcus aureus has been shown to colonise multiple family members sharing households. Because household items such as towels are often shared by family members, this study investigated whether cotton towel absorbency or washing conditions affect Staphylococcus aureus cell viability or cell retention, and whether the levels may be sufficient for person-to-person transmission. J Infect Dev Ctries. 2009;3(3):224-8.

**Are toilet seats a vector for transmission of methicillin-resistant Staphylococcus aureus? Giannini MA, Nance D, McCullers JA.**

The researchers studied the bacterial burden on toilet seats in a children's cancer hospital to validate a policy requesting that immunocompromised children use alcohol wipes on the seats prior to use of the toilets. Methicillin-resistant Staphylococcus aureus (MRSA) was recovered from 3.3% of hospital toilets when wipes were not in use. Use of wipes resulted in a 50-fold reduction in mean daily bacterial counts and eliminated MRSA.

**MRSA as a cause of lung infection including airway infection, community-acquired pneumonia and hospital-acquired pneumonia. Defres S, Marwick C, Nathwani D.**

Staphylococcus aureus has been recognised as a cause of community-acquired pneumonia, albeit uncommon, and an important cause of healthcare-associated (HA) pneumonia, including ventilator-associated pneumonia. Resistance of S. aureus to methicillin developed shortly after its introduction into clinical practice. Since then, methicillin-resistant S. aureus (MRSA) has predominantly been a feature of hospital-acquired, or latterly HA, infections as the boundaries became more blurred between the community and hospital environments. However, more recently true community-acquired (CA)-MRSA infections have been detected and are becoming increasingly common, especially in the USA. Europe has not been immune to the development of MRSA in healthcare settings and although the prevalence of CA-MRSA is currently relatively low, there is the risk of wider spread. These new CA-MRSA strains appear to behave differently to HA-MRSA strains. Although predominantly causing skin and soft tissue infections, mainly as boils and abscesses requiring drainage, life threatening invasive infections including necrotising pneumonia can also occur. This article summarises the pathogenesis and clinical presentations of MRSA-related lung infections. Eur Respir J. 2009;34(6):1470-6.

**Viruses in recreational water-borne disease outbreaks: a review. Sinclair RG, Jones EL and Gerba CP.**

Viruses are believed to be a significant cause of recreationally-associated waterborne disease. However, they have been difficult to document because of the wide variety of illnesses that they cause and the limitations in previous detection methods. Noroviruses are believed to be the single largest cause of outbreaks, which have been documented in the published literature 45% (n = 25), followed by adenovirus (24%), echovirus (18%), hepatitis A virus (7%) and coxsackieviruses (5%). Just under half of the outbreaks occurred in swimming pools (49%), while the second largest outbreak occurred in lakes or ponds (40%). The number of reported outbreaks associated with noroviruses has increased significantly in recent years probably because of better methods for virus detection. Inadequate disinfection was related to 69% (n = 18) of swimming pool outbreaks. A lack of required reporting and non-uniform water quality and chlorination/disinfection standards continues to contribute to water-borne recreational disease outbreaks. J Appl Microbiol. 2009 May 5. [Epub ahead of print]

**Household Outbreaks among Culture-confirmed Cases of Bacterial Gastrointestinal Disease. Ethelberg S, Olsen KEP, Gerner-Smidt P, Mølbak K.**

To examine the general frequency of household outbreaks, the authors performed a retrospective search among cases of the five most frequent gastrointestinal bacterial pathogens in Denmark, a country of 5.3 million inhabitants. This was done for 57,667 cases registered from 1991 to 2001 by finding all cases that shared addresses and became infected within 3 weeks of one another. The vast majority of the outbreaks had not previously been registered. The wide variation that was observed in the ability to cause household outbreaks among the different types of bacteria reflects differences in their epidemiology and most likely also mirrors their overall outbreak potential. Differences in the time occurring between infections of household members may also indicate differences in the importance of person-to-person transmission for the different types of bacteria. The fact that household outbreaks occur with a relatively high frequency may be utilised in future analyses of sources of infection, in particular of Campylobacter, for which more household outbreaks than expected were identified. Am J Epidemiol. 2004;159(4):406-12.

**Topic 3: Hygiene Procedures and their effectiveness**

**Effectiveness of common household cleaning agents in reducing the viability of human influenza A/H1N1. Greatorex JS, Page RF, Curran MD, Digard P, Enstone JE, Wreghitt T, Powell PP, Sexton DW, Vivancos R, Nguyen-Van-Tam JS.**

The purpose of this work was to test a representative range of common household cleaning agents. A British Standard (BS:EN 14476:2005) was modified to determine virus killing. 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 nonmicrobiocidal wipes and those containing only low concentrations (<5%) of surfactants showed lower anti-influenza activity. The study shows 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. PLoS One. 2010 Feb 1;5(2):e8987.

**Methods to evaluate the microbicidal activities of hand-rub and hand-wash agents. Rotter M, Sattar S, Dharan S, Allegranzi B, Mathai E, Pittet D.**

In vitro carrier tests, suspension tests, time-kill curves, and determinations of minimum inhibitory concentrations to evaluate the microbicidal activities of hand antiseptics provide only a preliminary indication of the antimicrobial spectrum and speed of action of a given formulation. This review provides a critical assessment of the methods currently used to meet regulatory requirements for hand antiseptics in Europe and North America. J Hosp Infect. 2009;73(3):191-9. Epub 2009 Sep 3.

**Infection control measures for norovirus: a systematic review of outbreaks in semi-enclosed settings. Harris JP, Lopman BA, O'Brien SJ.**

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. These results suggest that 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. J Hosp Infect. 2009 Oct 9. [Epub ahead of print]

**Evaluation of the bactericidal efficacy of three different alcohol hand rubs against 57 clinical isolates of S. Aureus. Cheeseman KE, Denyer SP, Hosein IK, Williams GJ, Maillard JY.**

The researchers tested the efficacy of three alcohol hand rubs (AHRs) used in two local Welsh intensive therapy units (ITUs) against Staphylococcus aureus. The test protocol was based on a carrier test and parameters (concentration, contact time) were chosen following observation of hand sanitising practices in the ITUs. Although the introduction of AHRs improved hand hygiene compliance among HCWs, these observations highlighted that contact time is an important factor to ensure the efficacy of these products. J Hosp Infect. 2009 ;72(4):319-25. Epub 2009 Jul 10.

**The antiviral action of common household disinfectants and antiseptics against murine hepatitis virus, a potential surrogate for SARS coronavirus. Dellanno C, Vega Q, Boesenberg D.**

The 2003 outbreak of severe acute respiratory syndrome (SARS) infected over 8000 people and killed 774. Transmission of SARS occurred through direct and indirect contact and large droplet nuclei. The World Health Organization recommended the use of household disinfectants, which have not been previously tested against SARS coronavirus (SARS-CoV), to disinfect potentially contaminated environmental surfaces. There is a need for a surrogate test system given the limited availability of the SARS-CoV for testing and biosafety requirements necessary to safely handle it. In this study, the antiviral activity of standard household products was assayed against murine hepatitis virus (MHV), as a potential surrogate for SARS-CoV. Am J Infect Control. 2009;37(8):649-52. Epub 2009 Aug 18.

**Combination of cell culture and quantitative PCR (cc-qPCR) to assess disinfectants efficacy on Cryptosporidium oocysts under standardized conditions. Shahiduzzaman M, Dyachenko V, Keidel J, Schmäscke R, Daugschies A.**

Oocysts of Cryptosporidium parvum are resistant to environmental conditions and many disinfectants. A combination of cell culture and quantitative real time PCR (cc-qPCR) is established for evaluation of anticoccidial disinfectants against C. parvum. Vet Parasitol. 2009 Sep 30. [Epub ahead of print]

**The antiviral action of common household disinfectants and antiseptics against murine hepatitis virus, a potential surrogate for SARS coronavirus. Dellanno C, Vega Q, Boesenberg D.**

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**Efficacy of Chemical Treatments Against Murine Norovirus, Feline Calicivirus, and MS2 Bacteriophage. D'Souza DH, Su X.**

Human noroviruses pose an emerging public health threat, and despite stringent control strategies, variant strains continue to spread and cause disease outbreaks. Routinely used chemical sanitisers such as sodium hypochlorite, though effective on food contact surfaces, require high concentrations to cause reduction in enteric viral titers. The aim of this study was to evaluate the efficacy of trisodium phosphate (TSP) against three human enteric virus surrogates, murine norovirus (MNV-1), feline calicivirus (FCV), and bacteriophage MS2 in comparison to routinely used sanitisers. *Foodborne Pathog Dis.* 2009 Nov 17. [Epub ahead of print]

**Effectiveness of Liquid Soap and Hand Sanitizer against Norwalk Virus on Contaminated Hands. Liu P, Yuen Y, Hsiao HM, Jaykus LA, Moe C.**

Disinfection is an essential measure for interrupting human norovirus (HuNoV) transmission, but it is difficult to evaluate the efficacy of disinfectants due to the absence of a practicable cell culture system for these viruses. 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 fingerpads. *Appl Environ Microbiol.* 2010;76(2):394-9. Epub 2009 Nov 20.

**Management of a multidrug-resistant *Acinetobacter baumannii* outbreak in an intensive care unit using novel environmental disinfection: A 38-month report. La Forgia C, Franke J, Hacek DM, Thomson RB Jr, Robicsek A, Peterson LR.**

Between June 1, 2004, and March 14, 2005, 16 patients in the surgical/medical intensive care unit (ICU) at a Chicago hospital were infected and another 2 were colonised with multidrug-resistant (MDR) *Acinetobacter baumannii*. This study describes the systematic investigation initiated to discover an environmental reservoir and a novel measure taken to terminate the outbreak. *Am J Infect Control.* 2009 Nov 7. [Epub ahead of print]

**Topic 4: Hygiene Intervention Studies**

**Measuring the effect of enhanced cleaning in a UK hospital: a prospective cross-over study. Dancer SJ, White LF, Lamb J, Girvan EK, Robertson C.**

This study aimed to evaluate the potential impact of one additional cleaner by using microbiological standards (aerobic colony counts) and the presence of *Staphylococcus aureus* including MRSA. Enhanced cleaning was associated with a 32.5% reduction in levels of microbial contamination at handtouch sites when wards received enhanced cleaning. Near-patient sites (lockers, overbed tables and beds) were more frequently contaminated with MRSA/*S. aureus* than sites further from the patient. Genotyping identified indistinguishable strains from handtouch sites and patients, supporting the possibility that patients acquired MRSA from environmental sources. There was a 26.6% reduction in new MRSA infections on the wards receiving extra cleaning, despite higher MRSA patient-days and bed occupancy rates during enhanced cleaning periods. Adjusting for MRSA patient-days and based upon nine new meticillin-resistant *S. aureus* infections seen during routine cleaning, we expected 13 new infections during enhanced cleaning periods rather than the four that actually occurred. Clusters of new MRSA infections were identified 2 to 4 weeks after the cleaner left both wards. Enhanced cleaning saved the hospital £30,000 to £70,000. *BMC Med.* 2009 Jun 8;7:28.

**The role of environmental cleaning in the control of hospital-acquired infection. Dancer SJ.**

The precise role of environmental cleaning in the control of HAIs remains unknown. Until cleaning becomes an evidence-based science, with established methods for assessment, the importance of a clean environment is likely to remain speculative. This review will examine the links between the hospital environment and various pathogens. Unfortunately, cleaning is often delivered as part of an overall infection control package in response to an outbreak and the importance of cleaning as a single intervention remains controversial. Recent work has shown that hand-touch sites are habitually contaminated by hospital pathogens, which are then delivered to patients on hands. It is possible that prioritising the cleaning of these sites might offer a useful adjunct to the current preoccupation with hand hygiene, since hand-touch sites comprise the less well-studied side of the hand-touch site equation. *J Hosp Infect.* 2009 Dec;73(4):378-85. Epub 2009 Sep 1.

**Child undernutrition, tropical enteropathy, toilets, and handwashing. Humphrey JH.**

This article explores the importance of toilets and hand hygiene in ensuring children grow normally in the developing world. The paper hypothesise that that improvements in this area could reduce the prevalence of tropical enteropathy, a condition in which the small intestine becomes inflamed and functions poorly due to bacterial infestation. Dr Humphrey uses an analogy of chickens to illustrate her point. Controlled studies have shown that chicks in dirty conditions can grow normally if they are fed antibiotics to stave off the bacteria they are exposed to in that environment; whereas chicks in the same conditions not given antibiotics do not grow as well. In both children and chickens, biological markers of inflammation increase substantially in unhygienic conditions, indicating that both children and chickens enter a 'near-continuous state of growth-suppressing immune response', in which dietary nutrients are directed away from growth

into providing energy and building materials for the immune response. The consequences on growth in children can be immense, especially in the first two years of life when growth demands are high. *Lancet*. 2009 Sep 19;374(9694):1032-5.

**Ascariasis and handwashing. Fung IC, Cairncross S.**

This review summarises evidence of the effectiveness of hand washing and the use of soap as a public health intervention against *Ascaris* infection, in terms of both prevalence and intensity. Literature in five major languages was searched and data were retrieved from 15 papers. The evidence of the effect of hand washing in general upon both prevalence and intensity of *Ascaris* infection is inconclusive. However, the use of soap in hand washing is protective against *Ascaris* infection with respect to prevalence. There is no direct evidence that it reduces the intensity of infection. *Trans R Soc Trop Med Hyg*. 2009 Mar;103(3):215-22. Epub 2008 Sep 11.

**Enteric illness risks before and after water treatment improvements. Frost FJ, Tollestrup K, Roberts M, Kunde TR, Craun GF, Harter L.**

This study evaluated whether occurrence of acute gastrointestinal illnesses declined after filtration and ozonation were added to a previously unfiltered, chlorinated high-quality surface water source in a northwest United States city. Enteric and other illnesses were recorded for two 6-month periods for control and intervention sites in the same city. During phase 1, chlorinated, unfiltered drinking water for both sites was obtained from protected watersheds. During phase 2, the intervention site received chlorinated, filtered and ozonated drinking water. The water was not altered in the control site. No overall differences were found in the risk of any of the illnesses after the new water treatment plant was completed. There was a significantly increased risk of diarrhoea and highly credible gastrointestinal illness in participants with three or more episodes of the same type of illness during phase 1. *J Water Health*. 2009;7(4):581-9.

**Effect of a Point-of-Use Water Treatment and Safe Water Storage Intervention on Diarrhea in Infants of HIV-Infected Mothers. Harris JR, Greene SK, Thomas TK, Ndivo R, Okanda J, Masaba R, Nyangau I, Thigpen MC, Hoekstra RM, Quick RE.**

To reduce mother-to-child transmission of human immunodeficiency virus (HIV) in resource-poor settings, the World Health Organization recommends exclusive breast-feeding for 6 months, followed by rapid weaning if replacement feeding is affordable, feasible, available, safe, and sustainable. In the Kisumu Breastfeeding Study (trial registration: Clinicaltrials.gov identifier NCT00146380), infants of HIV-infected mothers who received antiretroviral therapy experienced high rates of diarrhoea at weaning. To address this problem, mothers in the Kisumu Breastfeeding Study were given safe water storage vessels, hygiene education, and bleach for household water treatment. This study compares the incidence of diarrhoea in infants enrolled before (cohort A) and after (cohort B) implementation of the intervention. *J Infect Dis*. 2009;200(8):1186-93.

**Mandatory handwashing in elementary schools reduces absenteeism due to infectious illness among pupils: A pilot intervention study. Nandrup-Bus I.**

The objective of this study was to determine the effect of mandatory, scheduled hand washing on actual absenteeism due to infectious illness in elementary school pupils in Denmark. The results suggest that hand washing could be an effective tool to reduce absences due to infectious illness in elementary school pupils. A school policy regarding hand hygiene and teaching of hand hygiene is warranted. *Am J Infect Control*. 2009;37(10):820-6.

**Poorly Cleaned Public Cruise Ship Restrooms May Predict Norovirus Outbreaks. Carling P.**

A team of researchers from Boston University School (BUSM), Carney Hospital, Cambridge Health Alliance and Tufts University School of Medicine, have found that widespread poor compliance with regular cleaning of public restrooms on cruise ships may predict subsequent norovirus infection outbreaks (NoVOs). This study, which appears in the November 1st issue of *Clinical Infectious Diseases*, is the first study of environmental hygiene on cruise ships.

**Analysis of an outbreak of *Clostridium difficile* infection controlled with enhanced infection control measures. Salgado CD, Mauldin PD, Fogle PJ, Bosso JA.**

In October 2004, the *Clostridium difficile* infection (CDI) rate within a North American medical center increased from a baseline rate of 1.35 per 1000 patient-days. The authors describe the outbreak, the relationship between antibiotic use and CDI, and the effect of enhanced infection control measures (EICM) on CDI. The results led the researchers to conclude that despite an association between some antibiotic use and CDI rates, sustained control of an outbreak using EICM without formulary changes or new antibiotic control policies was achieved. This suggests that patient-to-patient spread may be a more important cause of increased CDI rates. *Am J Infect Control*. 2009;37(6):458-64. Epub 2009 Feb 25.

**Quantifying the burden of disease associated with inadequate provision of water and sanitation in selected sub-Saharan refugee camps. Cronin AA, Shrestha D, Spiegel P, Gore F, Hering H.**

In this study a WHO methodology is used for the first time to estimate the burden of disease directly associated with incomplete water and sanitation provision in refugee camps in sub-Saharan African

countries. A comparison with national morbidity estimates from WHO shows that although diarrhoea estimates in the camps are often higher, mortality estimates are generally much lower, which may reflect on more ready access to medical aid within refugee camps. The results reinforce the importance of increasing dialogue between the water, sanitation and health sectors and underline the fact that efforts to reduce refugee morbidity would be greatly enhanced by strengthening water and sanitation provision. *J Water Health*. 2009;7(4):557-68.

**Household water treatment in poor populations: is there enough evidence for scaling up now? Schmidt WP, Cairncross S.**

Point-of-use water treatment (household water treatment, HWT) has been advocated as a means to substantially decrease the global burden of diarrhoea and to contribute to the Millennium Development Goals. To determine whether HWT should be scaled up now, the researchers reviewed the evidence on acceptability, scalability, adverse effects, and non-health benefits as the main criteria to establish how much evidence is needed before scaling up. These aspects are contrasted with the evidence on the effect of HWT on diarrhoea. They found that the acceptability and scalability of HWT is still unclear, and that there are substantial barriers making it difficult to identify populations that would benefit most from a potential effect. *Environ Sci Technol*. 2009;43(4):986-92. Review.

**Facemasks and Hand Hygiene to Prevent Influenza Transmission in Households. A Cluster Randomized Trial. Cowling BJ, Chan KH, Fang VJ, Cheng CK, Fung RO, Wai W, Sin J, Seto WH, Yung R, Chu DW, Chiu BC, Lee PW, Chiu MC, Lee HC, Uyeki TM, Houck PM, Peiris JS, Leung GM.**

The study was carried to investigate whether hand hygiene and use of facemasks prevents household transmission of influenza in households in Hong Kong. Sixty (8%) contacts in the 259 households had RT-PCR–confirmed influenza virus infection in the 7 days after intervention. Hand hygiene with or without facemasks seemed to reduce influenza transmission, but the differences compared with the control group were not significant. In 154 households in which interventions were implemented within 36 hours of symptom onset in the index patient, transmission of RT-PCR–confirmed infection seemed reduced, an effect attributable to fewer infections among participants using facemasks plus hand hygiene (adjusted odds ratio, 0.33 [95% CI, 0.13 to 0.87]). Adherence to interventions varied. *Ann Intern Med*. 2009 Oct 6;151(7):437-46. Epub 2009 Aug 3.

**Impact of household hygiene and water source on the prevalence and transmission of Helicobacter pylori: a South Indian perspective. Ahmed KS, Khan AA, Ahmed I, Tiwari SK, Habeeb A, Ahi JD, Abid Z, Ahmed N, Habibullah CM.**

In developing countries, the *Helicobacter pylori* (*H. pylori*) infection rate is high, especially in lower socioeconomic groups. The study suggests that the risk of acquisition and transmission of *H. pylori* among the South Indian population can be reduced by improved household hygienic practices, proper waste disposal measures as well as the regular use of boiling water for drinking purposes. The prevalence of *H. pylori* was 80%. Prevalence increased with an increase in age and was found to be 90% in the 70-79 year age group. Prevalence of infection among people who drank water from wells was 92% compared with 74.8% of those who drank tap water. Infection prevalence was higher in people with low clean water index (CWI) (88.2%) compared with higher CWI (33.3%). While the prevalence in subjects with lower socioeconomic status was 86.1%, in higher groups, it was 70%. Prevalence was higher in subjects living in overcrowded houses (83.7%, 76.6% and 71.3% with high, medium and low crowding index). *Singapore Med J*. 2007 Jun;48(6):543-9.

**Topic 5: Promoting Hygiene Behaviour change**

**Household characteristics associated with handwashing with soap in rural Bangladesh. Luby SP, Halder AK, Tronchet C, Akhter S, Bhuiya A, Johnston RB.**

Hand washing with soap prevents diarrhoea and respiratory disease, but it is rarely practiced in high-need settings. Among 100 randomly selected villages in rural Bangladesh, field workers enrolled 10 households per village and observed and recorded household activities for 5 hours. Field workers observed 761 hand washing opportunities among household members in 527 households who had just defecated or who cleaned a child's anus who had defecated. In the final multivariate analysis, having water available at the place to wash hands after toileting and having soap available at the place to wash hands after toileting were associated with washing both hands with soap after faecal contact. Interventions that improve the presence of water and soap at the designated place to wash hands would be expected to improve hand washing behaviour and health. *Am J Trop Med Hyg*. 2009;81(5):882-7.

**Topic 6: Microbial resistance**

**Effect of subinhibitory concentrations of benzalkonium chloride on the competitiveness of Pseudomonas aeruginosa grown in continuous culture. Mc Cay PH, Ocampo-Sosa AA, Fleming GT.**

A continuous culture of *P. aeruginosa* was operated ( $D50.04 \text{ h}^{-1}$ , 792 h) with added benzalkonium chloride (BKC). A derivative, demonstrated a .12-fold decrease in sensitivity to the biocide (MIC .350 mg BKC l<sup>-1</sup>). The variant demonstrated a 256-fold increase in resistance to ciprofloxacin, with a mutation in *gyrA*. Similarly, culturing of the original strain in continuous culture with ciprofloxacin led to evolution of BKC-adapted populations. Efflux pump activity predominantly contributed to the phenotype. An amino acid substitution in *nfxB*, the Mex efflux system regulator gene, was observed for PA-29. Overexpression of MexAB-OprM and MexCD-OprJ was recorded. Results indicate the importance of environmental conditions on selection and maintenance of biocide adaptation. Microbiology. 2010 Jan;156(Pt 1):30-8. Epub 2009 Oct 8.

**Biocide and antibiotic resistance in staphylococcal isolates from household pets. Myers F, Rich M.**

The aim of the study was to compare biocide/antibiotic resistance in coagulase-positive staphylococci isolated from household pets. A total of 136 strains of MRSA, 48 strains of methicillin-sensitive *Staphylococcus aureus* (MSSA) and 96 strains of *Staphylococcus intermedius* were obtained from household pets in a U.K. veterinary diagnostic laboratory. A generally higher level of resistance to antibiotics was seen amongst the MRSA isolates compared to the MSSA isolates. Surprisingly resistance to biocides (especially triclosan) was found to be more prevalent in MSSA than in MRSA. Statistical analysis showed no significant evidence to link biocide/antibiotic resistance in coagulase-positive staphylococci isolated from household pets. European Society of Clinical Microbiology and Infectious Diseases. 18th European Congress of Clinical Microbiology and Infectious Diseases. Abstract number: R2297.

**Efflux pump activity in fluoroquinolone and tetracycline resistant *Salmonella* and *E. coli* implicated in reduced susceptibility to household antimicrobial cleaning agents. Thorrold CA, Letsoalo ME, Duse AG, Marais E.**

Whereas it has been shown that the inappropriate use of antimicrobial household agents selects for organisms with resistance mechanisms, which could lead to the development of antibiotic resistance, the hypothesis, that antibiotic-resistant organisms become tolerant to disinfectants due to the action of efflux pumps, has not been examined. In this study, tetracycline and ofloxacin sensitive and resistant *Escherichia coli* (9 strains) and *Salmonella* spp. (8 strains) were isolated from poultry and clinical samples. In order to assess whether these bacteria had active efflux pumps, ethidium bromide accumulation assays were performed. Extrusion of the active components of three commercial household agents (triclosan, sodium salicylate, and ortho-phenylphenol) by efflux pumps was tested using spectrophotometric accumulation assays. In order to simulate the kitchen environment, in-use disinfectant testing using the commercial household agents was performed. Active efflux pump activity and extrusion of all three active ingredients was observed only in the antibiotic resistant organisms. The antibiotic sensitive bacteria were also more susceptible than the resistant isolates to the household antimicrobial agents at below recommended concentrations. Int J Food Microbiol. 2007 Feb 15;113(3):315-20. Epub 2006 Nov 27.

**Topic 7: Hygiene Hypothesis**

**Commensal bacteria regulate Toll-like receptor 3-dependent inflammation after skin injury. Lai Y, Di Nardo A, Nakatsuji T, Leichtle A, Yang Y, Cogen AL, Wu ZR, Hooper LV, Schmidt RR, von Aulock S, Radek KA, Huang CM, Ryan AF, Gallo RL.**

The normal microflora of the skin includes staphylococcal species that will induce inflammation when present below the dermis but are tolerated on the epidermal surface without initiating inflammation. This research indicates a previously unknown mechanism by which a product of staphylococci inhibits skin inflammation. This inhibition is mediated by staphylococcal lipoteichoic acid (LTA) and acts selectively on keratinocytes. Activation is required for normal inflammation after injury. Staphylococcal LTA inhibits both inflammatory cytokine release from keratinocytes and inflammation triggered by injury through a TLR2-dependent mechanism. To our knowledge, these findings show for the first time that the skin epithelium requires TLR3 for normal inflammation after wounding and that the microflora can modulate specific cutaneous inflammatory responses. Nat Med. 2009 Dec;15(12):1377-82. Epub 2009 Nov 22.

**Commentary: The end of the hygiene hypothesis? Douwes J, Pearce N.**

This paper reviews a number of important pieces of evidence namely the high asthma prevalence in Latin America (which appears unlikely to have lower infection rates than Europe) and the decline in asthma prevalence in both adults and children in Western countries (which are unlikely to have become "less clean" in recent decades). The basic message is that the hygiene hypothesis, particularly in its original form, does not explain by itself the changes in the prevalence of asthma (mostly) and atopic disease more generally. For asthma, one confounding factor is the proportion of non-allergic asthma (which accounts for more than 50%), which clearly would not be influenced by microbial exposure. For atopic disease more generally, the conclusion is that the hygiene hypothesis in its later manifestations can

provide some mechanistic explanation for changing trends in prevalence, but that atopic disease is a multifactorial disease with many different elements modulating its development. *Int J Epidemiol.* 2008 Jun;37(3):570-2. Epub 2008 May 2.

**Hygiene hypothesis: wanted—dead or alive. Linneberg A.**

Linneberg in this letter offers a complementary explanation for the previous large increase and the recent small decline in asthma prevalence in several high income countries. Linneberg argues that the increase in allergic disease observed earlier may have been due to a lack of high allergen exposures in many westernized populations, and that a more recent increase in common environmental allergen exposure may have contributed to the recent decrease in prevalence by inducing immune tolerance. *Int J Epidemiol.* 2008 Dec 9. [Epub ahead of print]

**Hygiene hypothesis: wanted—dead or alive. Douwes J, Pearce N.**

This paper is a response to the letter by Linneberg Linneberg A Hygiene hypothesis: wanted—dead or alive. *International Journal of Epidemiology* 2008; Dec 9<sup>th</sup> 2008:1–2. *Int J Epidemiol.* 2008 Dec 9. [Epub ahead of print]

**The Hygiene Hypothesis: Do We Still Believe in It? Björkstén B.**

Although numerous epidemiological studies suggest that there is an inverse relationship between allergic diseases and infections in early childhood, there are also several well-conducted epidemiological studies that seemingly contradict this relationship. Björkstén concludes that Epidemiological, clinical and animal studies taken together suggest that broad exposure to a wealth of commensal, non-pathogenic microorganisms early in life are associated with protection, not only against IgE-mediated allergies, but also conceivably against type-1 diabetes and inflammatory bowel disease. He says “This has little relationship with 'hygiene' in the usual meaning of the word. The term 'hygiene hypothesis' is unfortunate, as it is misleading. A better term would be 'microbial deprivation hypothesis'.” *Nestle Nutr Workshop Ser Pediatr Program.* 2009;64:11-8; discussion 18-22, 251-7. Epub 2009 Aug 19.

**The role of lipopolysaccharide in the development of atopy in humans. Simpson A, Martinez FD.**

Atopy is a highly prevalent condition and remains the single biggest risk factor for asthma. Although atopy has a heritable component, the time frame of the increase in the prevalence indicates that it is not due to genetic factors alone. Lipopolysaccharide (LPS) and its bioactive moiety endotoxin are common to all gram-negative bacteria and can readily be measured in dust from homes. Some, but not all, studies have demonstrated an inverse dose–response relationship between exposure to endotoxin and the risk of atopy. It has now been demonstrated in four independent populations that high exposure to endotoxin in the domestic environment is protective against the development of atopy, but only among carriers of the C allele, that is, the environmental exposure is only relevant when taken in the context of the genotype. Furthermore, this interaction is biologically plausible. We propose that neither the environmental exposure nor the genotype in isolation is sufficient to cause complex diseases like asthma and atopy, but disease results from the one acting in the context of the other, of which CD14 and endotoxin is one example contributing to the risk for atopy. *Clin Exp Allergy.* 2009 Nov 25. [Epub ahead of print]

**Differences in allergy trends between East and West Germany and possible explanation. Krämer U, Oppermann H, Ranft U, Schäfer T, Ring J, Behrendt H.**

At the time of the German reunification in 1990, manifestations of most allergic diseases were less prevalent in East than in West Germany. It was hypothesized that these East–West differences would diminish with lifestyle and pollution changes in East Germany. This study investigated whether changes in the prevalence of asthma, hayfever, eczema or allergic sensitization in East Germany approached the levels seen in West Germany and aimed to identify possible lifestyle or environmental factors that may influence this. Lifestyle and pollution changed significantly differently between East and West Germany. The trends in hayfever and in strong (specific IgE >3.5) sensitization against pollen, and particularly birch pollen, were steeper in East than in West Germany. The trend towards marked pollen sensitization was four times stronger in East than West Germany. Increasing numbers of only children, less single-room heating with fossil fuels and increasing importance of traffic-related pollution in East Germany partly explained these differences in time trends. *Clin Exp Allergy.* 2010;(40):289–98.

**Is intrinsic asthma synonymous with infection? Dahlberg PE, Busse WW.**

Rackemann described the 'intrinsic asthma' population over 50 years ago as a unique subgroup that was characterised by onset of progressive loss of lung function beginning later in life, possibly after a respiratory infection. It has also been associated with a female predominance, aspirin-sensitive bronchospasm, and nasal polyposis. While the aetiology is not understood, the researchers propose that persistent respiratory infections play a central role in the development of intrinsic asthma. *Clin Exp Allergy.* 2009;39(9):1324-9. Epub 2009 Jul 23.

**Immunization via the anal mucosa and adjacent skin to protect against respiratory virus infections and allergic rhinitis: A hypothesis. Lloyd Spencer J.**

Exposure of the immune system to environmental antigens and infectious agents by way of the anal mucosa and perianal skin could play an important role in protecting the respiratory tract against allergic

conditions and virus infections. Hygienic practices that have reduced exposure of the immune system to such agents include the use of modern toiletry, disposable diapers and clothes dryers. Historically, the anal region was cleansed following defecation with natural materials that would have brought antigens and infectious agents from the environment into frequent contact with the perianal skin and anal mucosa. Furthermore, until the 1960s, diapers and other cloth items were often dried outdoors where they would have collected environmental antigens that, when applied to the body, could have made contact with the immune system in the skin. In this study, it is hypothesised that prevention of allergic rhinitis and possibly other disorders involving the immune system could be achieved by the daily application of preparations composed of environmental antigens and infectious agents to the anal mucosa and adjacent skin. Med Hypotheses. 2009 Oct 21. [Epub ahead of print]

**Early Daycare Is Associated with an Increase in Airway Symptoms in Early Childhood but Is No Protection against Asthma or Atopy at 8 Years. Caudri D, Wijga A, Scholtens S, Kerkhof M, Gerritsen J, Ruskamp JM, Brunekreef B, Smit HA, de Jongste JC.**

Day care exposes young children to more infections early in life and may thereby prevent the development of asthma and allergy. The objective of this study was to prospectively study the effects of day care on the development of asthma and allergic sensitisation during the first 8 years of life. Associations of day care and/or older siblings with asthma symptoms (wheezing, shortness of breath, and inhaled steroids taken in the last year), airway responsiveness, and allergic sensitisation were assessed in a longitudinal repeated-event analysis. Am J Respir Crit Care Med. ;180(6):491-8. Epub 2009 Jun 19.

**Exposure to Traffic-Related Particles and Endotoxin During Infancy Is Associated With Wheezing At Age Three. Ryan PH, Bernstein DI, Lockey J, Reponen T, Levin L, Grinshpun S, Villareal M, Hershey GK, Burkle J, LeMasters G.**

Murine models demonstrate a synergistic production of reactive oxygen species upon co-exposure to diesel exhaust particles and endotoxin. It was hypothesised that co-exposure to traffic-related particles and endotoxin would have an additive effect on persistent wheezing during early childhood. Persistent wheezing at age 36 months was assessed in the Cincinnati Childhood Allergy and Air Pollution Study, a high-risk birth cohort. A time-weighted average exposure to traffic-related particles was determined by applying a land-use regression model to the homes, daycares, and other locations where children spent time from birth through age 36 months. Indoor levels of endotoxin were measured from dust samples collected prior to age 12 months. The relationship between dichotomised (< / 75th percentile) traffic-related particle and endotoxin exposure and persistent wheezing, controlling for potential covariates, was examined. Am J Respir Crit Care Med. 2009;180(11):1068-75. Epub 2009 Sep 10.

**Topic 8: Safety issues**

**Domestic use of hypochlorite bleach, atopic sensitization, and respiratory symptoms in adults. Zock JP, Plana E, Antó JM, Benke G, Blanc PD, Carosso A, Dahlman-Höglund A, Heinrich J, Jarvis D, Kromhout H, Lillienberg L, Mirabelli MC, Norbäck D, Olivieri M, Ponzio M, Radon K, Soon A, van Sprundel M, Sunyer J, Svanes C, Torén K, Verlato G, Villani S, Kogevinas M.**

Professional use of hypochlorite (bleach) has been associated with respiratory symptoms. Bleach is capable of inactivating allergens, and there are indications that its domestic use may reduce the risk of allergies in children. This study looks at the associations between household use of bleach and atopic sensitisation, allergic diseases, and respiratory health status in adults. J Allergy Clin Immunol. 2009;124(4):731-8.e1. Epub 2009 Aug 8.

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The International Scientific Forum on Home Hygiene is a registered charity with the mission to provide practical advice and guidance on the promotion of health and wellbeing through improved hygiene. Its main activities include reviewing, interpreting, making accessible and communicating the scientific data relevant to preventing infectious disease transmission in the home.