



IFH Newsheet (www.ifh-homehygiene.org)

July 2009

How do you search online for information on infectious disease and home hygiene? – please tell us

IFH has been researching how our target audience searches online for information on infectious diseases and prevention through hygiene in the home and community – what search terms do people use – and how do they assess the potential value, quality and reliability of the material they find. So much of the information currently on line is focussed on infection control in healthcare settings. We wanted to find out how people search for information related to “out of hospital/healthcare” settings. We want to use these insights to improve the design of the site so that people who are searching for information on home hygiene through Google and other search engines are directed to our site and find the materials they need. If you have found our site useful in the past, please repay us by doing our online survey. It will only take you five minutes. In return it will help us to make the site better for you. We would particularly like to have feedback from users in countries where english is not the first language.

To carry out the survey click on the following link:

http://prism.gabba.net/home_hygiene_survey/

The global burden of hygiene-related diseases in relation to the home and community – a new report from IFH

The IFH report on the global burden of hygiene-related infectious diseases has now been completed and is available to download from the IFH website. This unique report draws together data on the global incidence and prevalence of hygiene-related infectious diseases focussing on the spread of these diseases in the home and community. The report illustrates what the benefits could be in terms of improving global health and well-being, if we could motivate people to take more responsibility for preventing the transmission of infectious disease in their own home through better hygiene practice. It also evaluates the various social, demographic and other factors which are shaping current trends in these infectious diseases. The report covers both developed and developing countries and compiles data from epidemiological and microbiological studies.

The report is available from: <http://www.ifh-homehygiene.org/IntegratedCRD.nsf/111e68ea0824afe1802575070003f039/29858aa006faaa22802572970064b6e8?OpenDocument>

IFH fact advice sheet - Swine flu: preventing spread in the home and community

In response to the flu pandemic IFH has produced a “fact/advice” sheet. This material explains the facts about swine flu and gives advice on what people can do to reduce the spread in the home and community. This “plain language” briefing material has been produced for those who work in healthcare professions, the media and others who are looking for background understanding of swine flu and/or those who are responsible for providing hygiene guidance to the public.

The advice sheet can be downloaded from: <http://www.ifh-homehygiene.org/IntegratedCRD.nsf/9c1b88071913b860802575070007d2f3/d65827d163a02bfb802575a700337c78?OpenDocument>

Few people changed their behaviour in the early stages of the swine flu outbreak – results of a UK telephone survey

Getting the public to adopt specific hygiene behaviours has proved useful in containing previous outbreaks of infectious disease, but motivating the public to adopt such behaviours can be difficult. In a recent study reported in the BMJ, researchers at King's College London and the UK Health Protection Agency set out to assess whether perceptions of the swine flu outbreak predicted changes in behaviour among members of the UK public. They telephoned 997 adults between 8 and 12 May 2009 and asked 9 questions about recent behaviours. Six of the behaviours studied related to avoidance of places or activities (such as avoiding large crowds or public transport), behaviours that had not been recommended by the government. Three related to activities that had been recommended - namely, increased cleaning or disinfecting of surfaces, washing hands with soap and water more often than usual, and discussing with a friend or family member what to do if either person caught swine flu.

The results suggest that, despite intense media coverage and a major government advertising campaign, public responses to swine flu were limited. Anxiety about the outbreak was low, with only 24% of participants reporting any anxiety and only 2% reporting high anxiety. Behaviour changes were limited. Most people reported that they had not changed their frequency of hand washing (72%), increased the amount that they cleaned or disinfected surfaces (83%), or discussed plans with a "flu friend" (85%). In fact most people (62%) had done none of these things. Fewer than 5% of people reported that they had avoided people or places as a result of the outbreak.

Factors associated with an increased likelihood of making these changes included perceptions that swine flu is severe, the risk of catching it is high, the outbreak will continue for a long time, the authorities can be trusted, and people can control their risk. In contrast, being uncertain about the outbreak and believing it has been exaggerated were associated with a lower likelihood of change, say the authors. The strongest predictor of behaviour change was ethnicity, with participants from ethnic minority groups being more likely to make recommended changes and carry out avoidance behaviours.

The authors concluded that the survey endorses the current policy of providing the public with clear, consistent information, which focuses on the practical things that people can do to reduce their risk and which maintains trust by explicitly discussing the current level of knowledge, preparation, and resources available to tackle the outbreak.

Rubin GJ, Amlot R, Page L, Wessely SG Public perceptions, anxiety, and behaviour change in relation to the swine flu outbreak: cross sectional telephone survey. BMJ Published 2 July 2009, doi:10.1136/bmj.b2651

Preventing transmission of influenza in the home and community – new data on the impact of masks, handwashing and alcohol hand gels

In an influenza pandemic, the limited supply of antivirals and vaccines in the early stages means that interventions such as hand hygiene and surgical face masks have

a major role to play in mitigating disease spread. While conventional wisdom proposes that hand hygiene, and perhaps surgical masks, could be effective measures to reduce household transmission, all available data have so far been derived from at best observational settings and mostly based on anecdotal evidence rather than controlled trials.

Cowling et al (PLoS ONE 2008 3(5): e2101. doi:10.1371/journal.pone.0002101) have published the preliminary findings of a randomised trial in Hong Kong. After influenza was confirmed in an index case, the household was randomised to 1) control or 2) surgical face masks or 3) hand hygiene. The study included index cases in 122 of households who had laboratory-confirmed influenza. There were 21 household contacts with laboratory confirmed influenza corresponding to a secondary attack ratio (SAR) of 6%. Although the data indicated little effect of the interventions in preventing household transmission, the authors recognised that the study was underpowered. It was concluded however that the results indicated that the follow up “main study” to be carried out in 2008 should have sufficient power to yield definitive results.

The authors observed that adherence to interventions was variable. More than one in four household contacts in the face mask group did not wear a surgical mask at all during the follow-up period, although more than one in four index cases in the control and hand hygiene intervention arms reported wearing masks at home of their own accord. Adherence to the hand hygiene intervention in terms of soap and alcohol use appeared low when benchmarked against rates recommended in healthcare settings. Interestingly the overall, the SAR was lower than expected. Only 6% of household contacts developed laboratory-confirmed influenza, and 5%–18% of contacts developed clinical influenza, depending on case definitions. This contrasts with previous studies in France, Seattle and other places, where SARs were approximately 25%

In another recent study Macintyre et al (Emerg Infect Dis 2009. <http://www.cdc.gov/EID/content/15/2/233.htm>) report prospective cluster-randomised trial comparing surgical masks, non-fit-tested P2 masks, and no masks in prevention of influenza-like illness (ILI) in households in Australia. During the 2006 and 2007 winter seasons, 286 exposed adults from 143 households exposed to a child with clinical respiratory illness were recruited. Results showed no significant difference in the risk of ILI in the mask use groups compared with the control group; however, <50% of those in the mask groups reported wearing masks most of the time. The authors concluded that household use of masks is associated with low adherence and is ineffective in controlling seasonal ILI. They argued, however, that if adherence were greater, as it might be during a pandemic, mask use might reduce transmission. In a follow-up editorial, Dr Macintyre stated “*More work is needed to look at the effectiveness of masks specifically, to evaluate their effectiveness in other community and healthcare settings, and the factors limiting compliance with mask use. We estimate that the reduction in risk of catching a respiratory infection for an adult caring for a sick child, when they adhere to mask use, is between 60 and 80%*”.

In our July newsheet of 2008 we reported the findings of Aiello and Monto from the first part of a 2 season study on the impact of masks and handwashing. The study, involving more than 1,000 student subjects from 7 University of Michigan residence halls, indicated that mask use and alcohol-based hand sanitiser use help reduce influenza-like illness rates, ranging from 10 to 50 percent. Aiello stressed however that the first year of the two-year project was a very mild flu season and only a few cases were positive for flu, so results should be interpreted cautiously. During year two of the study (2007-2008) a major outbreak of influenza took place. These studies

will show whether results observed during this more severe outbreak mirror those observed during the milder year one season.

The results of a recent study on the efficacy of soap and water and alcohol-based hand-rub preparations against live H1N1 influenza virus on the hands of a panel of human volunteers is also reported by Grayson et al (Clin Infect Dis. 2009 Feb 1;48(3):285-91). The study showed that handwashing with soap and water or use of alcohol-based hand rub is highly effective in reducing influenza A virus on human hands, although SW is the most effective intervention.

Pneumonia caused by CA-MRSA is usually preceded by flu

As community-acquired infections due to methicillin-resistant *Staphylococcus aureus* (CA-MRSA) increase, so lethal cases of CA-MRSA pneumonia are also on the rise. A paper in the June edition of The Lancet by Hidron et al (The Lancet Infectious Diseases 2009;9:384-92) looks at the evidence suggesting that CA-MRSA necrotising pneumonia appears to occur most commonly following an influenza-like illness. The concern is that the swine flu pandemic could trigger further increases in CA-MRSA pneumonia, as CA-MRSA appears to strike people who are already ill with flu. At present, in the USA, 6% of CA-MRSA infections cause serious invasive disease.

Decontamination of bottles used for feeding powdered infant formula

Infants, especially low birth weight and immuno-compromised neonates are particularly susceptible to gastrointestinal infections. Of particular concern are infections caused by *Enterobacter sakazakii*, *Salmonella enterica*, which can be associated with powdered infant formula (PIF). *E. sakazakii* causes infrequent, but often severe, infections, including sepsis, meningitis or necrotising enterocolitis. Mortality rates range from 20-50% and severe long lasting complications can occur. Outbreaks have been reported in a number of developed countries, but there is significant under-reporting in all countries. It has been suggested that intrinsic contamination of the PIF may be responsible for 50-80% of cases. However, in 20-50% of cases, it is suggested that poor hygiene during reconstitution (poor personal hygiene, poor environmental hygiene, poor cleansing and disinfection of bottles) was the cause.

In a recent study by Redmond and Griffith (J Fam Health Care 2009;19(1):26-31), bottles (n = 6) of reconstituted formula were spiked with 10(5) cfu/ml representative mixed culture. For subsequent experiments, reconstituted formula was spiked with either 10(2) and 10(4) cfu/ml of *Enterobacter sakazakii* (*Cronobacter*), *B. cereus* and *Staph. aureus*. Before disinfection, bottles were cleansed using hypochlorite-based solution and three heat-based methods. Results indicated that, if used according to the manufacturers' instructions, all methods have the potential to appropriately disinfect used bottles. However, observational studies of 5 parents (4 mothers, 1 father) cleaning and disinfecting bottles using their own preferred methods indicated that all participants implemented pre- and post- disinfection malpractices. The most common malpractices included failure to clean the worn surface and failure to dry hands adequately. Inadequacies in cleaning behaviour were largely due to the unacceptable use of cleaning implements, e.g. a washing-up brush or worn bottle brush. Errors resulted in 13-31% of microbiological failures, and a greater number of bottles and components disinfected in the steam steriliser exceeded benchmark clean values, compared to other disinfection methods. The study highlights the importance of effective consumer education by healthcare professionals. The work of

health visitors and the manufacturers of infant formula and bottle cleaning and disinfection equipment is vital in informing consumers.

Against Disease: The impact of hygiene and cleanliness on health – a new monograph on the impact of hygiene on health

In 1984, The US Soap and Detergent Association published the monograph "Cleanliness and the Health Revolution". The monograph brought together a largely ignored picture of the role that cleanliness has had in reducing the incidence of disease-related morbidity and mortality. This new publication, authored by Allison Aiello, Elaine Larson and Richard Sedlak, is an update of that work. It keeps much of the structure and content of the original, but also includes a paper on personal hygiene and household cleanliness in the home. This supplement is written for healthcare professionals, and is intended to support efforts to communicate more clearly with the community about the role of hygiene in the prevention of infection. It addresses the development of hygiene from a historical perspective through to the present day. The supplement includes an examination of the effectiveness of handwashing as well as household cleaning and disinfecting practices today in removing and killing microbes. The ultimate conclusion is that the current status of cleanliness and the resulting health benefits in developed countries shouldn't be taken for granted. The monograph shows that sanitary diligence is as pertinent to health today as it was a century ago. The authors conclude that "the health revolution and the sanitary revolution are still in progress. There are great strides yet to be made in some regions of the world". The monograph is published in the American Journal of Infection Control, vol 36, issue 10, Supplement (December 2008) and is free to download from [http://www.ajicjournal.org/issues/contents?issue_key=S0196-6553\(08\)X0013-6](http://www.ajicjournal.org/issues/contents?issue_key=S0196-6553(08)X0013-6)

Water, sanitation and hygiene standards in schools in low-cost settings – new guidelines from WHO

Guidelines on water, sanitation and hygiene in schools are widely available, but additional guidance and standards for low-cost settings is needed. To meet this need WHO have prepared guidelines which deal specifically with water, sanitation and hygiene and are designed to be used in schools in low-cost settings in medium- and low-resource countries to:

- Assess prevailing situations and plan the improvements that are required
- Develop and reach essential safety standards as a first goal
- Support the development and application of national policies

The guidelines deal with water supply, hygiene promotion, sanitation, control of vector-borne disease, cleaning and waste disposal and food storage preparation. They are written for use by education managers and planners, architects, urban planners, water and sanitation technicians, teaching staff, school boards, village education committees, local authorities and similar bodies. The draft- WASH Standards in Schools in Low-cost Settings is edited by John Adams, Jamie Bartram, Yves Chartier, Jackie Sims and is available from: [http://www.who.int/water sanitation health/hygiene/settings/wash standards schools per review2.doc](http://www.who.int/water_sanitation_health/hygiene/settings/wash_standards_schools_per_review2.doc)

Norovirus and Salmonella were Leading Causes of Foodborne Disease Outbreaks in the US in 2006

According to the US surveillance report, there were 1,270 reported foodborne disease outbreaks in 2006, resulting in 27,634 illnesses and 11 deaths. Among these

1,270 outbreaks, 621 had a confirmed single cause; the cause was most often norovirus (54% of outbreaks), followed by *Salmonella* (18 % of outbreaks). The analysis was done on data from the 243 outbreaks in which a single food commodity was reported to CDC. Foodborne outbreaks of norovirus occur most often when infected food handlers do not wash their hands after using the toilet; foodborne outbreaks of *Salmonella* occur most often when foods contaminated with animal faeces are eaten raw or insufficiently cooked. Food commodities associated with the largest number of cases of illness in 2006 were poultry (21% of outbreak-associated cases), leafy vegetables (17%), and fruits-nuts (16%). The report can be found at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5822a1.htm>

South East Asia Hygiene Practitioners Workshop – February 2010

Though hygiene is not explicitly mentioned in the Millennium Development Goals hygiene has to make an important contribution to the improvement of the lives of the poor. The simple act of washing hands at critical times - after defecation, before eating, etc. - has the potential of reducing the incidence of diarrhoea by around 40%. However, experience shows that hygiene and behavioural change receive limited attention in WASH projects and that the range of agreed good practices is small. In order to provide practitioners with a chance to share and discuss proven good practices and to explore common ground on what works and doesn't work, the Water Supply and Sanitation Collaborative Council (WSSCC), IRC, WaterAid, and BRAC plan to organise a South Asian Hygiene Practitioners' Workshop in Dhaka, Bangladesh in February 2010.

A call for abstracts describing concrete experiences or outcomes of research in the field of hygiene and behavioural change has been circulated and abstracts can be submitted until 31 July 2009. Abstracts should preferably relate to experiences in the sanitation and water sectors but also practitioners from other sectors such as the health sectors are invited to submit an abstract. For more information, contact Ms Carolien van der Voorden at WSSCC: vandervoordenc@who.int

Household Water Treatment & Safe Storage Network – Technical Meeting, 21st – 23rd September 2009

The 2009 International Research Colloquium of the Network to Promote Household Water Treatment and Safe Storage (HWTS09) will take place in Dublin, Ireland from 21st – 23rd September 2009. The main objective of the meeting is to consolidate effective strategies for addressing barriers in introducing, scaling up and achieving sustainable HWTS interventions at a country level and how this can be applied, particularly in African regions or other developing countries. Local Organising Committee: Kevin McGuigan (Chair), Loraine Monard (Registrations). Website: www.rcsi.ie/hwts09. Phone: +353 1 402 2437, Email: hwts09@rcsi.ie

Launch of the e-bug project

Following 3 years of intensive research, design and evaluation, the e-bug educational resource will be launched at the Russell Hotel, London on 3rd/4th September 2009. The meeting will be attended by delegates from the Ministries' of Health and Education as well as teaching professionals from partner countries and other stakeholders. Following the initial meeting, the resource will then be disseminated in schools across the 18 European partner countries.

e-Bug, is an educational resource pack and accompanying website, sponsored by DG-SANCO of the European Commission, led by the Health Protection Agency UK, and consisting of 18 EU partner countries. The resource was designed to enhance student knowledge on four key areas:

- Introduction to Microbes
- Transfer of Infection
- Treatment of Infection
- Prevention of Infection

The resource contains a series of fun and interactive lesson plans for both junior (9 - 11 yr olds) and senior (12 -15 yr olds) school students, each of which links closely to the national curriculum.

Antimicrobial resistance remains one of the key problems within community and hospital settings in Europe. This could be tackled by prudent antibiotic use through improved public and professional education. In many European countries, antibiotic prescription rates are highest in children. Within schools, respiratory and gastrointestinal infections are a major cause of childhood illness with poor respiratory and hand hygiene contributing to increased spread of infection.

Global Handwashing Day 2009

October 15th 2009 will be the second Global Handwashing Day. This annual event started last year, as an initiative to advocate for and promote handwashing with soap. The driving force behind Global Handwashing Day is the Public-Private Partnership for Handwashing with Soap, but the day is supported and implemented by organisations from public, private and civil society sectors round the world.

In 2008, activities took place in 73 countries across Africa, Asia, Europe and the Americas. The focus of events this year will be on the school child, as children suffer most from diarrhoeal diseases and are also powerful agents of behaviour change. Planned activities in the UK include activities in schools, and the 'Golden Poo' Awards – an animated film competition on the theme of hygiene and sanitation. For more information, go to <http://globalhandwashingday.org>.

LIBRARY OF RECENT PUBLICATIONS

Topic 1: Disease Incidence

Cytomegalovirus Infection Causes an Increase of Arterial Blood Pressure. Cheng J, Ke Q, Jin Z, et al. PLoS Pathog. 2009;5(5):1000427. doi:10.1371/journal.ppat.1000427

Cytomegalovirus (CMV) infection is a common infection in adults (seropositive 60–99% globally), and is associated with cardiovascular diseases, in line with risk factors such as hypertension and atherosclerosis. Viral infections linked to hypertension include human herpes virus 8 (HHV-8) and HIV-1. The mechanisms of how viral infection contributes to hypertension or increased blood pressure are not defined. In this report, the role of CMV infection as a cause of increased blood pressure and in forming aortic atherosclerotic plaques is examined. The results show that CMV infection is a risk factor for increased arterial blood pressure, and is a co-factor in aortic atherosclerosis.

The Prevalence of Enteroviral Capsid Protein vp1 Immunostaining in Pancreatic Islets in Human Type 1 Diabetes. Richardson SJ, Willcox A, Bone AJ, et al. Diabetologia. 2009;52:1143-51. doi:10.1007/s00125-009-1276-0

A common virus may be the trigger for the development of many cases of diabetes, particularly in children. Signs of enteroviruses were found in pancreatic tissue from 60% of children with type 1 diabetes, but in hardly any children without the disease. The study also

found that 40% of adults with type 2 diabetes had signs of the infection in insulin-producing cells.

A Unique Dual Activity Amino Acid Hydroxylase in *Toxoplasma gondii*. Gaskell EA, Smith JE, Pinney JW, et al. PLoS ONE. 2009;4(3):4801.

Toxoplasmosis parasites may play a role in the development of schizophrenia and other bipolar disorders by affecting the production of dopamine - the chemical that relays messages in the brain controlling aspects of movement, cognition and behaviour. Toxoplasmosis, which is transmitted via cat faeces (found on unwashed vegetables) and raw or undercooked infected meat, is relatively common, with 10-20% of the UK population and 22% of the US population estimated to carry the parasite as cysts. Most people with the parasite are healthy, but for those who are immune-suppressed - and particularly for pregnant women - there are significant health risks that can occasionally be fatal.

Modulation of Acute Diarrheal Illness by Persistent Bacterial Infection. McBee ME, Zheng PZ, Rogers AB, et al. Infection and Immunity. 2008;76(11):4851-8.

Acute diarrhoeal illness is a global health problem that may be exacerbated by concurrent infection. Using *Citrobacter rodentium*, a murine model of attaching and effacing diarrheagenic *Escherichia coli*, the researchers demonstrated that persistent *Helicobacter hepaticus* infection modulates host responses to diarrhoeal disease, resulting in delayed recovery from weight loss and from tissue damage. This model of polymicrobial infection provides insight into the mechanism by which subclinical infection can exacerbate morbidity due to an unrelated self-limiting infection.

Climate Change and Infectious Diseases in Europe. Semenza J, Menne B. Lancet Infect Dis. 2009;9:365-75.

Concerted action is needed to address public health issues raised by climate change. The review discusses infections acquired through various routes (arthropod vector, rodent, water, food, and air) in view of a changing climate in Europe. It presents an assessment of how infectious disease challenges: incidence, prevalence, and distribution are projected to shift in a changing environment. Due to the high level of uncertainty on the rate of climate change and its impact on infectious diseases, a proactive public health response is proposed by building an integrated network for environmental and epidemiological data. This network would have the capacity to connect epidemic intelligence and infectious disease surveillance with meteorological, entomological, water quality, remote sensing, and other data, for multivariate analyses and predictions. Insights from these analyses could then guide adaptation strategies and protect population health from impending threats related to climate change.

Emergence of Community-acquired Methicillin-resistant *Staphylococcus Aureus* Strain USA300 as a Cause of Necrotising Community-onset Pneumonia. Hidron A, Low CE, Honig EG, et al. Lancet Infect Dis. 2009;9:384-92.

Methicillin-resistant *Staphylococcus aureus* (MRSA), usually known as a nosocomial pathogen, has emerged as the predominant cause of skin and soft-tissue infections in many communities. Concurrent with the emergence of community-acquired MRSA (CA-MRSA), there have been increasing numbers of reports of community-acquired necrotising pneumonia in young patients and others without the classic healthcare-associated risk factors. Community-onset necrotising pneumonia due to CA-MRSA is now recognised as an emerging clinical entity with distinctive clinical features and substantial morbidity and mortality. The best treatment of this partly toxin-mediated disease has not been clearly defined. Whereas cases of CA-MRSA pneumonia have now been reported from almost every continent, the overall burden of disease of this emerging syndrome remains incompletely described. This paper reports two related cases of community-onset pneumonia due to the MRSA USA300 genotype and reviews the literature regarding the emergence of CA-MRSA pneumonia.

***Stenotrophomonas maltophilia*: An Emerging Opportunist Human Pathogen. Looney J, Narita M, Muhlemann K. Lancet Infect Dis. 2009;9:312-23.**

Stenotrophomonas maltophilia has emerged as an important opportunistic pathogen in the debilitated host. *S. maltophilia* is not an inherently virulent pathogen, but its ability to colonise respiratory-tract epithelial cells and surfaces of medical devices makes it a ready coloniser of hospitalised patients. *S. maltophilia* can cause bloodstream infections and pneumonia with

considerable morbidity in immunosuppressed patients. Management of infection is hampered by high-level intrinsic resistance to many antibiotic classes and the increasing occurrence of acquired resistance to the first-line drug co-trimoxazole. Prevention of acquisition and infection depends upon the application of modern infection-control practices, with emphasis on the control of antibiotic use and environmental reservoirs.

Household Contact Investigation of Tuberculosis in Low-income and Middle-income Countries: Public-health Impact. Chang KC, Leung CC, Tam CM. Lancet Infect Dis. 2009;9(1):3-4.

A systematic review has shown that household contact investigation merited serious consideration as a means to improve tuberculosis control in low-income and middle-income countries with a high incidence of the disease. The pooled yield among all household contacts was 4.5% (4.3–4.8%, $I^2=95.5\%$) for all active tuberculosis, and 2.3% (2.1–2.5%, $I^2=96.6\%$) for confirmed active tuberculosis. Substantial heterogeneity exists across studies, possibly related to variations in source, environmental, or contact characteristics, screening methods, and diagnostic thresholds.

Risk of Waterborne Illness via Drinking Water in the United States. Reynolds KA, Mena KD, Gerba CP. Rev Environ Contam Toxicol. 2008;192:117-58.

From 1971 to 2002, there were 764 documented waterborne outbreaks associated with drinking water, resulting in 575,457 cases of illness and 79 deaths. Here the researchers provide estimates of waterborne infection and illness risks in the U.S. based on the total number of water systems, source water type, and total populations exposed. Furthermore, they evaluated all possible illnesses associated with the microbial infection and not just gastroenteritis. The results indicate that 10.7 M infections/yr and 5.4 M illnesses/yr occur in populations served by community groundwater systems; 2.2 M infections/yr and 1.1 M illnesses/yr occur in noncommunity groundwater systems; and 26.0 M infections/yr and 13.0 M illnesses/yr occur in municipal surface water systems. The total estimated number of waterborne illnesses/yr in the U.S. is therefore estimated to be 19.5 M/yr. Epidemiological studies are conflicting on the benefits of POU water treatment. One prospective intervention study found that consumers of reverse-osmosis (POU) filtered water had 20%-35% less gastrointestinal illnesses than those consuming regular tap water, with an excess of 14% of illness due to contaminants introduced in the distribution system. Two other studies using randomised, blinded, controlled trials determined that the risks were equal among groups supplied with POU-treated water compared to untreated tap water.

Surveillance for Foodborne Disease Outbreaks – United States, 2006. Morbidity and Mortality Weekly Report. June 12 2009;58(22):609-15.

US surveillance reported 1,270 foodborne disease outbreaks in 2006, resulting in 27,634 illnesses and 11 deaths. Among these 1,270 outbreaks, 621 had a confirmed single cause; the cause was most often norovirus (54% of outbreaks), followed by *Salmonella* (18 % of outbreaks). Foodborne outbreaks of norovirus occur most often when infected food handlers do not wash their hands after using the toilet; foodborne outbreaks of *Salmonella* occur most often when foods contaminated with animal faeces are eaten raw or insufficiently cooked. Food commodities associated with the largest number of cases of illness in 2006 were poultry (21 % of outbreak-associated cases), leafy vegetables (17%), and fruits-nuts (16%). The report can be found at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5822a1.htm>

The Role of Colonization Pressure in Nosocomial Transmission of Methicillin-resistant *Staphylococcus aureus*. Williams V, Callery S, Vearncombe M, et al. AJIC. 2009;37(2):106-10.

Colonised or infected patients are a major reservoir for patient-to-patient transmission of methicillin-resistant *Staphylococcus aureus* (MRSA) in hospitals. Despite attempted adherence to recommended infection prevention and control procedures, a general medicine unit in the study hospital continued to experience ongoing transmission of MRSA. The role that colonisation pressure (CP) plays in nosocomial transmission of MRSA on a general medicine unit was assessed, and a threshold CP above which additional IP&C practices should be implemented was proposed. From January 2005 to December 2006, all patients admitted to a 36-bed general medicine unit were screened on admission for MRSA. Monthly MRSA nosocomial incidence (new nosocomial cases \times 1000/susceptible patient-days) and CP (number of MRSA patient-days \times 100/total patient-days) were calculated. The relative risk

(RR) of MRSA transmission above and below the median CP with 95% confidence interval was calculated. Twenty-one cases of nosocomially acquired MRSA were detected during the study period, with transmission occurring in 8 separate months. The median CP during the 2 years was 6.7%. The RR of MRSA acquisition increased as CP increased above the median (RR, 7.6; 95% CI: 1.1-52.6; P = .008). MRSA outbreaks were declared on 2 separate occasions, and, in each, the CP for the preceding month was greater than the median value of 6.7%. The conclusion was that CP has a significant effect on the subsequent transmission of MRSA on a general medicine unit. Ongoing monitoring of CP provides the opportunity for early implementation of enhanced infection prevention and control practices and can potentially decrease nosocomial transmission of MRSA and prevent outbreaks.

National Point Prevalence of *Clostridium difficile* in US Health Care Facility Inpatients, 2008. Jarvis WR, Schlosser J, Jarvis AA, et al. AJIC. 2009;37(4):263-70.

Recently published estimates of *Clostridium difficile* infection (CDI) incidence have been based on small numbers of hospitals or national hospital discharge data. These data suggest that CDI incidence is increasing. The researchers conducted a point prevalence survey of *C. difficile* in inpatients at US healthcare facilities. The survey was developed, received Institutional Review Board approval, and was then distributed to all Association for Professionals in Infection Control and Epidemiology, Inc (APIC) members. They were asked to complete the survey on 1 day between May 7 and August 29, 2008, reporting the number of inpatients with CDI or colonisation and facility-specific information. Personnel at 648 hospitals completed the survey; this represents approximately 12.5% of all US acute care facilities. All but 3 states and the District of Columbia were represented (mean, 14 facilities per state; range, 2-43). Eighty-two percent reported that their CDI rate had not decreased in the past 3 years. Respondents reported 1443 *C. difficile*-colonised/infected patients among 110,550 inpatients; the overall *C. difficile* prevalence rate was 13.1 per 1000 inpatients (94.4% infection). Detailed data were provided on 1062 (73.6%) patients. Of these, 55.5% were female, 69.2% were >60 years of age, 67.6% had selected comorbid conditions, 79% had received antimicrobials within 30 days, and 94.4% were detected by enzyme immunoassay. The majority of patients (54.4%) were diagnosed ≤48 hours of hospitalisation, but 35% had been admitted to a long-term care facility within 30 days, and 47% had been hospitalised within 90 days; 73% met Centers for Disease Control and Prevention criteria for healthcare-associated CDI. Most facilities (>90%) used contact isolation for CDI patients. Bleach was used for environmental disinfection more commonly during CDI outbreaks than during nonoutbreak periods. This survey documents a higher *C. difficile* prevalence rate than previous estimates using different methodologies. The majority of inpatient CDI appears to be healthcare associated. Given that not all patients with diarrhoea are tested for CDI and that most facilities use enzyme immunoassays with limited sensitivity to detect *C. difficile*, these are minimum estimates of the US healthcare facility *C. difficile* burden.

Sudden Increases in Listeriosis Rates in England and Wales, 2001 and 2003. Cairns BJ, Payne RJH. Emerg Infect Dis. 2009;15(3):465-8.

The monthly incidence of listeriosis infections in England and Wales had 2 sudden increases during April 2001 (41%) and March 2003 (48%). Although no causative association is demonstrated, these increases correspond to key dates relating to the onset and aftermath of the 2001 foot and mouth disease outbreak in the United Kingdom.

***Clostridium difficile*-associated Disease in the Elderly, United States. Jagai J, Naumova E. Emerg Infect Dis. 2009;15(2):343-44.**

The researchers assessed trends of *Clostridium difficile*-associated Disease (CDAD) in the elderly by using hospital billing data from the Centers for Medicare and Medicaid Services (CMS), which covers 98% of the elderly population. All hospitalisation records that included *C. difficile* were abstracted. There was an observed increase in overall hospitalisations that included a diagnosis for CDAD. The highest rate of hospitalisations was detected in the oldest patients (>85 years of age). There was also an observed increase in the percentage of patients with CDAD who died, from 8.8% in 1993 to 9.7% in 2004, which is an annual increase of 0.075% over the 12-year period. There was also an observed a peak in 2000; 10.4% of patients with CDAD died. This peak is unusual and unexplained and requires further analysis. There was an increasing trend and strong seasonal pattern in CDAD hospitalisations. This may be due to an increase in disease or may be caused by increased testing and recognition of disease. Increases may also be due to a reporting bias of

gastroenteric diseases. To assess this possibility, all records that included other infectious gastroenteritis without CDAD were extracted and the trend was compared with CDAD hospitalisations. Rates for all other GI infections remained fairly constant over the study period, and a reporting bias for GI infections does not account for the ≈3-fold increase in CDAD hospitalisations. The researcher's conclusions support the observations of Zilberberg et al, 2008. and demonstrate the substantial increase in CDAD-related hospitalisations over time. These findings and the ageing population in the United States underscore the need for further research to understand all aspects of CDAD.

Estimating the Global Burden of Foodborne Diseases – a Collaborative Effort. Kuchenmüller T, Hird S, Stein C, et al. Eurosurveillance. 2009;14(18):1-4.

Illness and death from diseases caused by unsafe food are a constant threat to public health security as well as socioeconomic development throughout the world. The full extent of the burden and cost of foodborne diseases associated with pathogenic bacterial, viral and parasitic microorganisms, and food contaminated by chemicals is still unknown but is thought to be substantial. The World Health Organization (WHO) Initiative to estimate the global burden of foodborne diseases aims to fill the current data gap and respond to the increasing global interest in health information. Collaborative efforts are required to achieve the ambitious task of assessing the foodborne disease burden from all causes worldwide. Recognising the need to join forces, the WHO Initiative has assembled an alliance of stakeholders which share and support the Initiative's vision, intended objectives and outcomes. One important collaborator is the European Centre for Disease Prevention and Control (ECDC) which has embarked on a burden of disease study covering at least 18 foodborne diseases in nearly 30 countries.

Hepatitis A in the European Union: Responding to Challenges Related to New Epidemiological Patterns. Payne L, Coulombier D. Eurosurveillance. 2009;14(3):1-2.

Hepatitis A is a vaccine-preventable acute, usually self-limiting disease caused by infection with the hepatitis A virus (HAV). Transmission is usually by the faecal-oral route, including via person-to-person spread, contaminated water or food products. It has also been associated with injecting drug use and outbreaks among men having sex with men. In the European Union (EU), though figures may vary among countries, the overall incidence of hepatitis A has decreased over the last 10 years from 15.1 per 100,000 population in 1996 to 3.9 per 100,000 in 2006. This decreasing trend has been attributed to continued improved sanitary and living conditions, with reduced exposure to infection, especially in early childhood. However, reduction in circulation of HAV leads to decreased acquisition of immunity and, in the absence of universal vaccination, an accumulation of susceptible individuals. Though the total number of cases may be decreasing yearly in the EU, the articles published in this edition of Eurosurveillance indicate that hepatitis A is still an important public health issue, and highlight the need for increased awareness of both the risk of infection to the individual and the possibility of community outbreaks within a changing EU epidemiology.

CTX-M β -Lactamases in *Escherichia coli* from Community-acquired Urinary Tract Infections, Cambodia. Ruppé E, Hem S, Lath S, et al. Emerg Infect Dis. 2009;15(5):741-8.

Despite the recent global spread of CTX-M β -lactamases in *Escherichia coli* isolates from community-acquired urinary tract infections (CA-UTIs), their dissemination has been little studied in developing countries. In a 2-year prospective study, the researchers documented the prevalence of extended-spectrum β -lactamases (ESBLs) in *E. coli* that were responsible for CA-UTIs in Phnom-Penh, Cambodia. Ninety-three *E. coli* strains were included. They observed a high prevalence of resistance to amoxicillin (88.2% of strains), cotrimoxazole (75.3%), ciprofloxacin (67.7%), gentamicin (42.5%), and third-generation cephalosporins (37.7%). A total of 34 strains carried ESBLs, all of which were CTX-M type. CTX-M carriage was associated with resistance to fluoroquinolones and aminoglycosides. Using repetitive extragenic palindromic-PCR, the researchers identified 4 clusters containing 9, 8, 3, and 2 strains. The prevalence of CTX-M β -lactamases has reached a critical level in Cambodia, which highlights the need for study of their spread in developing countries.

Zoonotic Infections in Europe in 2007: A Summary of the EFSA-ECDC Annual Report. Westrell T, Ciampa N, Boelaert F, et al. Eurosurveillance. 2009;14(3):1-3.

The European Food Safety Authority and the European Centre for Disease Prevention and Control have just published their Community Zoonoses Report for 2007, analysing the occurrence of infectious diseases transmittable from animals to humans. *Campylobacter* infections still topped the list of zoonotic diseases in the European Union and the number of *Salmonella* infections in humans decreased for the fourth year in a row. Cases of listeriosis remained at the same level as in 2006, but due to the severity of the disease, more studies on transmission routes are warranted. The report highlights the importance of continued co-operation between veterinarians and public health specialists, both at the EU level and within Member States.

Topic 2: Infection Transmission

Contamination of Pet Therapy Dogs with MRSA and Clostridium difficile. Lefebvre SL, Weese JS. J Hosp Infect. 2009;72:268-9.

This report is a study of 26 pet therapy dog-handler teams, 12 of which visited acute care and 14 of which visited long-term care facilities in southern Ontario, Canada. One (4%) dog (a Greyhound) acquired *C. difficile* on its paws during its visit to an acute care facility. The isolate possessed the genes for all three toxins and was identified as an epidemic strain (NAP1/ribotype 027). MRSA was detected on the hands of the investigator after petting a Pug that had visited a long-term care facility. Although only 13 (50%) handlers were observed to practice hand hygiene at least once during the visit, none of the handlers had positive test results for any of the pathogens. The results strongly suggested that dogs became contaminated with pathogens during the visits. The dog that acquired *C. difficile* on its paws had been encouraged to 'shake paws' with patients during the visit. The dog that acquired MRSA had been repeatedly placed on beds and was kissed on the head by two patients.

Community-acquired methicillin-resistant Staphylococcus aureus ST398 Infection, Italy. Pan A, Battisti A, Zoncada A, et al. Emerg Infect Dis. 2009;15:845-6.

Community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) has been identified in livestock animals (particularly pigs), veterinarians, and animal farm workers. The researchers report on a case of invasive infection in a pig-farm worker in an intensive animal farming area in Italy, the infection was caused by MRSA of swine origin, ST398. Attention should be given to the emergence of MRSA strains among animals, and continuous surveillance in humans should monitor the extent of disease from MRSA ST398, especially in areas of intensive animal farming.

Methicillin Resistance of Airborne Coagulase-negative Staphylococci in Homes of Persons Having Contact with a Hospital Environment. Lis DO, Pacha Z, Idzi QD. AJIC. 2009;37:177-82.

The aim of this study was to evaluate the airborne *Staphylococcus* genus features in homes in which inhabitants have had contact with the hospital environment. A higher prevalence of methicillin-resistant (MR) strains among the species isolated (40% of *S epidermidis*, 40% of *S hominis*, and 60% of *S cohnii* spp *cohnii*) was found in homes of persons who had contact with a hospital environment compared with the reference homes (only 12% of *S hominis*). The *mecA* gene was revealed in all MR *S epidermidis* strains and in some MR *S hominis* (50%) and *S cohnii* spp *cohnii* (33%) strains. The results indicate that persons having contact with a hospital environment pose a risk of intrafamilial spreading of MR strains via the air.

Risk of Infection in the Home Environment. Plea for a New Risk Assessment. Exner M, Gebel J, Heudorf U, et al. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2008;51(11):1247-57. Review. German.

Within the last two decades risks posed by infectious diseases outside of hospitals and nursing homes had no high significance in the public perception. The home environment is regarded as a safe shelter from infectious risks. In the mean time there have been dramatic socio-demographic, health policy and technological changes which have increased infectious risks outside medical facilities. In Germany up to 1.4 million people with multiple morbidities are nursed at home. Technological changes with the aim to protect the environment, like reduction of water temperature and water volumes in washing processes has lowered the efficacy to control pathogens. Thus it is time to revise the process of risk assessment in which not only aspects of environmental protection but also those of health protection must be taken into account. The article gives an overview of new risks and epidemiological changes and

discusses the necessity of a new risk assessment and risk management approach which hopefully will lead to a changing paradigm.

Prevention of Infection Through Hygiene in the Home and Community. The Need for a Family-centred Approach. Bloomfield SF, Exner M, Dietlein E. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2008;51(11):1258-63. German.

Over the past 20 years, infectious disease has moved back up the health agenda, prompting new emphasis on developing strategies for prevention and control, including reduction of spread of infection within the family at home and in their social and work lives outside the home. This paper reviews the various issues that have contributed to this trend. In response to the need for a science-based approach to home hygiene, the International Scientific Forum on Home Hygiene has developed an approach based on risk management which involves identifying the critical control points for preventing the spread of infectious diseases in the home. If we are to be successful in achieving behaviour change in the community, we need to develop a family-centred approach which ensures an understanding of infectious disease agents and their mechanism of spread.

***Clostridium difficile* in Ready-to-Eat Salads, Scotland. Bakri MM, Brown DJ, Butcher JP, et al. Emerg Infect Dis. May 2009. Accessed 14 July 2009. Available from: <http://www.cdc.gov/EID/content/15/5/817.htm> DOI: 10.3201/eid1505.081186**

Of 40 ready-to-eat salads, 3 (7.5%) were positive for *Clostridium difficile* by PCR. Two isolates were PCR ribotype 017 (toxin A-, B+), and 1 was PCR ribotype 001. Isolates were susceptible to vancomycin and metronidazole but variably resistant to other antimicrobial drugs. Ready-to-eat salads may be potential sources for virulent *C. difficile*. Over the past decade, *C. difficile* infection has become a prominent cause of healthcare-associated infection. Although *C. difficile* has been thought of traditionally as a predominantly nosocomial infection, the incidence of community-acquired cases has increased recently, as has the incidence of cases from other healthcare settings such as nursing homes. Notably, some evidence has shown that *C. difficile* may be brought into the healthcare environment by asymptomatic carriers. The reported carriage rates of *C. difficile* in healthy adults have varied from 0% to 3% in Europe to up to 15% in Japan. Little is known, however, about the prevalence of *C. difficile* in the environment and how it may be transmitted to humans. *C. difficile* has been found in a variety of environments, including water, soil, animal faeces, and foods; these findings suggest that *C. difficile* may be transmitted to humans through food, although no foodborne cases have been reported. Because ready-to-eat foods have been implicated in foodborne disease outbreaks associated with *Salmonella* species and *Escherichia coli* O157, the researchers examined ready-to-eat salads for the presence of *C. difficile*.

Is Faecal Contamination of Drinking Water after Collection Associated with Household Water Handling and Hygiene Practices? A Study of Urban Slum Households in Hyderabad, India. Eshcol J, Mahapatra P, Keshapagu S. J Water Health. 2009;7(1):145-54. doi:10.2166/wh.2009.094

Water-borne illness, primarily caused by faecal contamination of drinking water, is a major health burden in the state of Andhra Pradesh, India. Currently, drinking water is treated at the reservoir level and supplied on alternate days, necessitating storage in households for up to 48 hrs. The researchers hypothesised that faecal contamination occurs principally during storage due to poor water handling. In this study they tested for coliform bacteria in water samples collected at distribution points as household storage containers were filled, and then tested containers in the same households 24–36 hours after collection. The researchers also conducted an observational survey to make an assessment of water handling and hygiene. Ninety-two percent (47/51) of samples tested at supply points were adequately chlorinated and bacterial contamination was found in two samples with no residual chlorine. Samples collected from household storage containers showed an increase in contamination in 18/50 houses (36%). Households with contaminated stored samples did not show significant differences in demographics, water handling, hygiene practices, or sanitation. Nevertheless, the dramatic increase in contamination after collection indicates that until an uninterrupted water supply is possible, the point at which the biggest health impact can be made is at the household level.

Management of Norovirus Gastroenteritis in the Community. Gould D. Br J Community Nurs. 2009;14(3):117-21.

Noroviruses are the most common cause of infectious gastrointestinal disease in the community. This article explores the epidemiology of Noroviruses and discusses strategies for prevention and control in community settings. Noroviruses are spread by the faecal-oral route and are highly infectious. Sound hygiene in kitchens, bathrooms and thorough hand washing and careful environmental cleaning with bleach are important to prevent spread.

Detection of Infectious Rotavirus in Naturally Contaminated Source Waters for Drinking Water Production. Rutjes SA, Lodder WJ, Docters van Leeuwen A, et al. J Appl Microbiol. 2009;107:97-105.

To assess public health risks of rotavirus via drinking water consumption, a cell culture-PCR assay was developed and optimised for the detection of infectious environmental rotavirus strains in naturally contaminated source waters for drinking water production. Infectious rotavirus concentrations were estimated by an optimised cell culture-PCR assay as most probable numbers by using the presence or absence of replicated virus in different sample volumes. Infectious rotavirus was detected in 11 of 12 source water samples in concentrations varying from 0.19 (0.01-0.87) to 8.3 (1.8-34.0) infectious PCR detectable units per litre (IPDU / l), which was not significantly different from the concentrations of infectious enterovirus in these samples. In 55% of the samples, rotavirus genomes were 1000 to 10 000 times ($3 \log_{10}$ - $4 \log_{10}$) more abundantly present than infectious rotavirus particles, whereas in the remaining 45% of the samples, rotavirus genomes were less than 1000 times ($<3 \log_{10}$) more abundantly present. The broad variation observed in the ratios of rotavirus RNA and infectious particles demonstrates the importance of detecting infectious viruses instead of viral RNA for the purposes involving estimations of public health risks.

Spread of Bacteria on Surfaces when Cleaning with Microfibre Cloths. Bergen LK, Meyer M, Høg M, et al. J Hosp Infect. 2009;71:132-7.

The impact of environmental contamination on nosocomial cross-transmission is mostly unresolved and in Danish hospitals assessment of cleaning is based on visible criteria only. The use of premoistened microfibre cloths and the 16-side method have been introduced into Danish hospitals because of economic and ergonomic advantages but they have not been evaluated for applicability in hospital cleaning. The researcher's hypothesis was that this method may spread bacteria. A surface was contaminated with bacteria (4 cfu/bacteria/cm²), and cleaned with a premoistened microfibre cloth folded to 16-side use. Each of 15 sterile surfaces was cleaned with a new side of the microfibre cloth; imprints were made and the experiment repeated 12 times. After cleaning, the contaminated surface imprints of microfibre cloths showed a median of 45.5 cfu/plate for *E. faecalis* and 2.5 cfu/plate for *B. cereus*. Median values from imprints from cloth sides 2-16 were between 1 and 12 cfu/plate for *E. faecalis* and 0 cfu/plate for *B. cereus*. Imprints of the contaminated surfaces were a median of 45.5 cfu/plate for *E. faecalis*, giving a reduction of 5.6-fold. For *B. cereus* the median value was 0 cfu/plate. The surface numbers 2-16 had median values between 0.5 and 7.5 for *E. faecalis*, which was spread to 11-15 of the 15 sterile surfaces ($P < 0.01$). *B. cereus* was found in six out of 180 imprints on surfaces 2-16, all with 1 cfu/plate (non-significant). The implication is that although there was an overall reduction in bacterial counts on the contaminated surface, bacteria were spread to subsequently cleaned surfaces.

Risk Factors for Increased Mortality from Hospital-acquired Versus Community-acquired Infections in Febrile Medical Patients. Groeneveld AJ. AJIC. 2009;37(1):35-42.

BACKGROUND: Risk factors for hospital-acquired infection and attributable mortality in surgical and critically ill patients are well-known. We sought to identify factors associated with increased mortality from hospital-acquired infections as compared with community-acquired infections in patients with new-onset fever and a presumed infectious focus ($n = 212$), in a department of internal medicine. **METHODS:** Demographic, clinical, and laboratory variables were studied for 2 days after inclusion. Septic shock and outcome were monitored for up to 7 and 28 days after inclusion, respectively. **RESULTS:** Of the 212 patients, 54 had hospital-acquired and 158 community-acquired infection, with septic shock rates of 15% and 4% and mortality rates of 24% and 6% ($P = .001$), respectively. Prior neurologic disease was associated with death. Patients with hospital-acquired infection had more often (intravascular) devices and underwent more often interventions, had a different distribution of infectious foci, and had more often bacteremia. Bacteremia-associated septic shock was associated with

nonsurvival in both infection groups. The causative agents were not associated with outcome, and the clinical and laboratory host response associated with nonsurvival generally did not differ among infection groups. **CONCLUSION:** Our data suggest that hospital-acquired infections carry a higher crude mortality rate than community-acquired infection in febrile medical patients, mainly because of more frequent use of devices and hospital interventions and resultant bacteremia and septic shock, rather than by differences in underlying diseases, causative agents, and clinical and laboratory host responses. The observations thus emphasize the continued importance of preventive measures on medical wards of our hospital and can be used for comparison with future studies.

Survival of *Campylobacter* spp. in Bovine Faeces on Pasture. Gilpin BJ, Robson B, Scholes P, et al. Letters in Applied Microbiology. 2009;48:162-6.

The objective of this study was to determine the survival on pasture of *Campylobacter* spp. naturally present in bovine faeces and compare this with a previously published study using laboratory-cultured *Campylobacter* spp. Ten freshly collected cow pats were deposited on pasture during summer, and *Campylobacter* spp. were enumerated by enrichment broth culture. The counts in three pats were below detection limits. Counts of *Campylobacter* spp. in the other seven pats fell below detection limits within 14 days. The geometric means of the counts up to 7 days produced a T_{90} of 2.2 days. Characterisation of *Campylobacter* spp. by PCR and pulsed field gel electrophoresis indicated the presence of at least six genotypes of *Campylobacter jejuni*, *Campylobacter coli* and *Campylobacter lari*. The conclusions were that *Campylobacter* spp. naturally present in cow faeces exhibited a similar survival rate to that previously determined using laboratory-cultured strains. The highly variable counts of naturally occurring *Campylobacter* spp., and the predominance of lower counts, also support the earlier decision to use laboratory-cultured strains in survival experiments. This study reaffirms the short survival of *Campylobacter* spp. in cow faeces deposited on pasture. This information will be incorporated into a 'reservoir model' for *Campylobacter* spp. in cow pats on New Zealand pastures.

Survival of Enveloped and Non-enveloped Viruses on Surfaces Compared with other Micro-organisms and Impact of Suboptimal Disinfectant Exposure. Howie R, Alfa MJ, Coombs K. J Hosp Infect. 2008;69:368-76.

Survival of enveloped and non-enveloped viruses was compared with that of bacteria, yeasts and mycobacteria when dried on the surface of polyvinyl chloride test carriers in the presence or absence of an organic matrix. The efficacy of glutaraldehyde and accelerated hydrogen peroxide (AHP) disinfectants was evaluated. Reovirus, a non-enveloped virus, persisted and had an RF of 2 after 30 days whereas *Enterococcus faecalis* had an RF of 4 over the same time period. The other test organisms (Sindbis virus, *Pseudomonas aeruginosa*, *Mycobacterium chelonae* and *Candida albicans*) had variable survivals but none survived as long as 30 days. Both glutaraldehyde and AHP were effective at manufacturer's recommended dilutions for high-level disinfection. However, only 7% AHP eliminated a glutaraldehyde-resistant strain of *M. chelonae*. Breakthrough survival was detected at 0.1% glutaraldehyde and 0.05% AHP for all organisms tested. The researchers' data emphasise the need for effective cleaning and disinfection in nosocomial settings to prevent pathogen transmission.

Survival of *Salmonella* on Refrigerated Chicken Carcasses and Subsequent Transfer to Cutting Board. Jiménez SM, Tiburzi MC, Salsi MS, et al. Letters in Applied Microbiology. 2009;48:687-91.

The objective of this study was to determine the effect of refrigeration time and temperature on *Salmonella* cell numbers on inoculated chicken carcasses and their transfer to a plastic cutting board. The survival of *Salmonella* on chicken skin and the transfer to a plastic cutting board when exposed to different refrigeration temperatures (2, 6 or 8°C) for 9 days were the two main issues on which this work focused. Two scenarios were carried out to ascertain these effects: carcasses treated with a decontaminating acetic acid solution and untreated carcasses. All of the contaminated carcasses remained contaminated after 9 days of refrigeration. However, on untreated samples, while *Salmonella* numbers increased almost 1.5 log at 8°C, the pathogen numbers decreased about 1 log at 2 and 6°C. On acid-treated samples, cell numbers slightly decreased at all of the temperatures studied. Temperature did not affect *salmonellae* transfer to the cutting board, but time did. Acid decontamination increased cell numbers transferred to the cutting board compared with untreated samples.

The conclusion was that proper refrigeration at low temperatures did not allow *Salmonella* numbers to rise, regardless of which carcasses had been, or had not been, acid treated. Despite the fact that the rate of transfer was not affected by temperature, the acid treatment detached *Salmonella* cells from the chicken skin and, therefore, the probability of greater cross-contamination should be studied further. The results of this study may provide better information about the refrigeration conditions for fresh chicken storage and also determine if these, along with acetic acid decontamination of broiler chicken, would affect the pathogen transfer to a cutting board.

Development of a Method to Measure Bacterial Transfer from Hands. Lingaas E, Fagernes M. J Hosp Infect. 2009;72:43-9.

A method was developed to investigate the transfer of bacteria from the hands of healthcare workers (HCWs). The method involved standardised hand contact between the HCW and a recipient wearing sterile gloves, followed by sampling of the bare hands of the HCW and the gloved hands of the recipient by the glove juice method. The duration of contact, degree of friction and dryness of the hands could be varied. The researchers investigated the applicability of the method for measuring transfer from hands artificially contaminated with *Escherichia coli* as well as from naturally contaminated hands following a 30 s contact time with moderate friction and dry hands. Only a small proportion of bacteria on donor hands was recovered from the recipient: 0.15% for *E. coli* and 0.07% for natural hand flora. A smaller proportion of *E. coli* was recovered from bare skin compared with gloves, suggesting reduced survival of bacteria as a result of contact with natural skin. The researchers suggest that these data are clinically relevant, and may indicate low transfer of bacteria during short contact with dry hands. This method is suitable to investigate the effect of potential risk factors for ineffective hand hygiene and the effect of hand hygiene procedures on contact transmission in clinical studies with large numbers of HCWs.

Prevention and Control of Infections in the Home. Embil JM, Dyck B, Plourde P. CMAJ. Abridged article published May 26, 2009. DOI:10.1503/cmaj.071898.

Increasing concern exists that antimicrobial-resistant microorganisms can be acquired in the community or that they can be introduced into the community from healthcare facilities. Antimicrobial resistance may also evolve or be acquired in the community and be introduced into a healthcare facility from the community, where the infection can spread widely. The suggestions presented in this review provide a basic approach that can be applied to prevent the transmission of current antimicrobial-resistant pathogens and those that may arise in the future.

Risk Factor Analysis of Diarrhoeal Diseases in the Aral Sea Area (Khorezm, Uzbekistan). Herbst S, Fayzieva D, Kistemann T. Int J Environ Health Res. 2008;18(5):305-21.

In the Aral Sea basin, human activities have resulted in the severe degradation of water and soil, which is considered to cause serious human health problems. This study investigated the risk factors: water, sanitation and related hygiene issues for diarrhoeal disease in Khorezm province, Uzbekistan. The risk factors were studied using a combination of quantitative and qualitative methods including water quality monitoring, standardised questionnaires and spot checks. Multiple linear regression analysis revealed that visible contamination of drinking water during storage and the absence of anal cleansing materials were significantly associated with the number of diarrhoeal episodes per household. Overall, the findings of the study show that the domestic domain plays a major role with regard to faecal-oral disease transmission in Khorezm, Uzbekistan. Unhealthy excreta disposal habits and unsafe drinking water storage practices have to be urgently tackled in order to break the faecal-oral transmission route.

Community-acquired Methicillin-resistant *Staphylococcus aureus* ST398 Infection, Italy. Pan A, Battisti A, Zoncada A, et al. Emerg Infect Dis. 2009;15(5):845-7.

Community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) has been identified in livestock animals (particularly pigs), veterinarians, and animal farm workers. CA-MRSA strains from pigs have been classified most frequently within the multilocus sequence type (ST) 398 and have been rarely identified as a cause of invasive infection in humans. This article reports on a case of invasive infection in a pig-farm worker in Cremona, Italy, an intensive animal farming area; the infection was caused by MRSA of swine origin, ST398.

Methicillin-Resistant *Staphylococcus aureus* in Poultry. Persoons D, Van Hoorebeke S, Hermans K, et al. Emerg Infect Dis. 2009;15(3):452-3.

Methicillin-resistant *Staphylococcus aureus* (MRSA) has been detected in several species and animal-derived products. To determine whether MRSA is present in poultry, the researchers sampled 50 laying hens and 75 broiler chickens. MRSA was found in some broiler chickens but no laying hens. In all samples, spa type t1456 was found.

Possible Seasonality of *Clostridium difficile* in Retail Meat, Canada. Rodriguez-Palacios A, Reid-Smith RJ, Staempfli HR, et al. Emerg Infect Dis. 2009;15(5):802-5.

The researchers previously reported *Clostridium difficile* in 20% of retail meat in Canada, which raised concerns about potential foodborne transmissibility. Here, they study the genetic diversity of *C. difficile* in retail meats, using a broad Canadian sampling infrastructure and 3 culture methods. They found 6.1% prevalence and indications of possible seasonality (highest prevalence in winter).

Moisture, Sawdust, and Bleach Regulate the Persistence of *Escherichia coli* O157:H7 on Floor Surfaces in Butcher Shops. Williams AP, Avery LM, Killham K, et al. Food Control. 2008;19:1119-25. © 2007 Elsevier Ltd. All rights reserved.

Survival of *Escherichia coli* O157:H7 on typical butcher shop ceramic floor tiles contaminated with meat juice was compared in the presence and absence of sawdust, and under different moisture and cleaning regimes. Floor tiles from a butcher shop were cut into 5 x 5 cm pieces, and half were cleaned with commercial bleach diluted with water at 60°C to simulate mopping. A coating of commercial sawdust was applied to half of the tiles, while the other half were left bare. Meat juice collected from beef joints was inoculated with *E. coli* O157:H7 (strain #3704), and subsequently applied onto tiles at a density of 6.47 log₁₀ CFU cm⁻². Thereafter, tiles were stored at room temperature (20 ± 2 °C), with half maintained under moist conditions [relative humidity (RH) close to 100%] and the other half gradually air-dried (RH 70 ± 5%). Viable *E. coli* O157:H7 persisted on all tiles over 72 h, although die-off rate varied with environmental conditions. Desiccation of surfaces resulted in a more rapid decline in *E. coli* O157:H7 numbers, while cleaning of the tiles with bleach prior to contaminating also affected pathogen recovery. Overall, greater numbers of cells were recovered from tiles when no sawdust had been applied; however the presence of sawdust only reduced survival on tiles under dry conditions, and damp sawdust actually increased survival. This highlights the importance of regular cleaning and removal of sawdust to reduce pathogen persistence.

Formattato: Inglese (U.S.A.)

Topic 3: Hygiene Procedures

Use of Sodium Dichloroisocyanurate for Floor Disinfection. Williams GJ, Denyer SP, Hosein IK, et al. J Hosp Infect. 2009;72:279-81.

Bactericidal efficacy on surfaces was assessed using a carrier test based on the British Standard EN 13697. *S. aureus* strains from clinically infected ITU patients were used. When 1000 ppm was applied to clean surfaces contaminated with *S. aureus* strains, NaDCC achieved a bactericidal effect after 30 s. The researchers observed a difference in inactivation kinetics between individual strains when experiments were conducted under dirty conditions, particularly among the MRSA strains, although all isolates remained susceptible to exposures of 2 min. Considerably longer contact times (3.5 min) were required when the strains were exposed to a dilute 500 ppm solution in the presence of an organic load. The researchers found no difference in susceptibility between MSSA and MRSA.

Bite-related and Septic Syndromes Caused by Cats and Dogs. Oehler RL, Mizrahi M, Lamarche J, et al. Lancet Infect Dis. 2009;9(7):439-47.

Bite infections can contain a mix of anaerobes and aerobes from the patient's skin and the animal's oral cavity, including species of *Pasteurella*, *Streptococcus*, *Fusobacterium*, and *Capnocytophaga*. Domestic cat and dog bite wounds can produce substantial morbidity and often require specialised care techniques and antibiotic therapy. Wounds can be complicated by sepsis. Disseminated infections, particularly those caused by *Capnocytophaga canimorsus* and *Pasteurella multocida*, can lead to septic shock, meningitis, endocarditis, and other severe sequelae. An emerging syndrome in veterinary and human medicine is methicillin-resistant *Staphylococcus aureus* (MRSA) infections shared between pets and human handlers, particularly community-acquired MRSA disease involving the USA300 clone. Skin, soft-tissue, and surgical infections are the most common. MRSA-associated infections in pets

are typically acquired from their owners and can potentially cycle between pets and their human acquaintances. As community-acquired MRSA becomes more prevalent, there is an increased chance of it being passed between humans and animals.

Disinfection Methods Used in Decontamination of Bottles Used for Feeding Powdered Infant Formula. Redmond E, Griffith CJ. J Fam Health Care. 2009;19(1):26-31.

Bottles (n = 6) of reconstituted formula were spiked with 10(5) cfu/ml representative mixed culture. For subsequent experiments, reconstituted formula was spiked with either 10(2) and 10(4) cfu/ml of *Enterobacter sakazakii* (Cronobacter), *B. cereus* and *Staph. aureus*. Before disinfection, bottles were cleaned according to recommended guidelines. Disinfection procedures tested included a hypochlorite-based chemical solution and three heat-based methods. Bottles were sampled in four sites. Before cleaning and disinfection, the inner screw cap and inner-teat were the most heavily contaminated sites with 1.6-7.4 x 10(3) cfu/per-area-sampled; the bottle interior was more contaminated overall with 1.2 x 10(4) cfu/per-area-sampled. After disinfection, adherence to recommended procedures (combined with good hygiene) enabled effective decontamination to be achieved using all methods. The study highlights the importance of effective consumer education by healthcare professionals.

Survival of Enveloped and Non-enveloped Viruses on Surfaces Compared with Other Micro-organisms and Impact of Suboptimal Disinfectant Exposure. Howie R, Alfa MJ, Coombs K. J Hosp Infect. 2008;69:368-76.

Survival of enveloped and non-enveloped viruses, bacteria, yeasts and mycobacteria dried on polyvinyl chloride test carriers was determined. Reovirus, a non-enveloped virus, persisted and had a RF of 2 after 30 days whereas *E. faecalis* had an RF of 4 over the same time period. The other test organisms (Sindbis virus, *P. aeruginosa*, *Mycobacterium chelonae* and *Candida albicans*) had variable survivals but none survived as long as 30 days. Glutaraldehyde and hydrogen peroxide were effective at recommended dilutions. Breakthrough survival was detected at 0.1% glutaraldehyde and 0.05% AHP for all organisms tested.

In Vitro Study of the Effect of Cationic Biocides on Bacterial Population Dynamics and Susceptibility. Moore LE, Ledder RG, Gilbert P, et al. Appl Environ Microbiol. 2008;74(15):4825-34. Epub 2008 May 30.

Cationic biocides (CBs) are widely used in domestic and public hygiene and to control biofouling and microbial contamination in industry. The increased use of biocides has led to concern regarding possible reductions in biocide effectiveness. Domestic drain microcosms were stabilised for 5 months and then exposed to polyhexamethylene biguanide (PHMB) at 0.1, 0.2, and 0.4g liter(-1) over 6 months and characterised throughout by differential culture, together with eubacterial-specific PCR-denaturing gradient gel electrophoresis. Additionally, MICs and minimal bactericidal concentrations (MBCs) for bacteria previously isolated from a domestic drain (n = 18) and the human skin (n = 13) were determined before, during, and after escalating, sublethal exposure (14 passages) to two quaternary ammonium compounds (QAC1 and QAC2), the bisbiguanide chlorhexidine (CHX), and PHMB. Exposure of the drain microcosm to PHMB did not decrease the total viable count although significant (P < 0.01) decreases in recovery were observed for the gram-positive cocci with associated clonal expansion of pseudomonads (from ca. 0.1% of the population to ca. 10%). This clonal expansion was also manifested as elevations in bacteria that could grow in the presence of PHMB, CHX, and QAC1. Decreases in susceptibility (greater than twofold) occurred for 10/31 of the test bacteria for QAC1, 14/31 for QAC2, 10/31 for CHX, and 7/31 for PHMB. Exposure of microcosms to PHMB targeted gram-positive species and caused the clonal expansion of pseudomonads. In terms of prolonged-sublethal passage on CBs, exposure to all the biocides tested resulted in susceptibility decreases for a proportion of test bacteria, but refractory clones were not generated.

Limitations of the Efficacy of Surface Disinfection in the Healthcare Setting. Williams GJ, Denyer SP, Hosein IK, et al. Infect Control Hosp Epidemiol. 2009;30(6):570-3.

The researchers examined the efficacy of 2 commercially available wipes to effectively remove, kill, and prevent the transfer of both methicillin-resistant and methicillin-susceptible *Staphylococcus aureus* from contaminated surfaces. Although wipes play a role in decreasing the number of pathogenic bacteria from contaminated surfaces, they can potentially transfer bacteria to other surfaces if they are reused.

The Benefits of Silver in Hygiene, Personal Care and Healthcare. Edwards-Jones V. Letters in Applied Microbiology. 2009;49:147-52.

Silver has been used for centuries as an antimicrobial agent to reduce bioburden and prevent infection. Its usage diminished when antibiotics were introduced but remained one of the most popular agents for wound infections, especially in burned patients. Incorporation of silver into a range of hygiene and healthcare applications has increased, and this has raised concerns over the development of silver resistance, toxicity, methods of testing products and evidence of efficacy. The published evidence for resistance and toxicity is limited and associated with frequent and high levels of silver used. Increasing evidence of improved antimicrobial activity of nanoparticles of silver and possible dual immunomodulatory effects are exciting. This may lead to further product development as potential alternative preservatives as some currently available preservatives have an increasing incidence of allergic reactions.

Washing Toys in a Neonatal Intensive Care Unit Decreases Bacterial Load of Potential Pathogens. J Hosp Infect. Naesens R, Jeurissen A, Vandepuut C, et al. 2009;71(2):197-8.

57 toys of 57 infants from two neonatal intensive care units (University Hospital Gasthuisberg, Leuven, and GZA Sint-Augustinus, Wilrijk, Belgium) were analysed for their microbial load before and after the washing procedure. Before washing, 13/57 toys (23%) were positive for potential pathogens (eight contained *S. aureus*, three *Enterococcus spp.*, one *Klebsiella pneumoniae* and one *Pseudomonas aeruginosa*). Postwashing cultures resulted in 5/57 (9%) positive cultures (four revealed *Enterococcus spp.*, one *S. aureus*), which was a significant decrease compared with the pre-wash cultures.

Efficacy of Sanitizing Agents against *Listeria monocytogenes* Biofilms on High-Density Polyethylene Cutting Board Surfaces. Yang H, Kendall PA, Medeiros LC, et al. J Food Prot. 2009;72(5):990-8.

This study compared the effectiveness of 10 commercially available sanitisers against *Listeria monocytogenes* biofilms on high-density polyethylene cutting boards. Smooth and rough surface high-density polyethylene coupons (2 by 5 cm) were inoculated (approximately 6 log CFU/cm²) with a five-strain composite of *L. monocytogenes* in ham homogenate and incubated at 24 degrees C and > or = 90% relative humidity for up to 21 days. The coupons were subjected to repeated 24-h cycles simulating use and cleaning in the home. Each day, 0.3 ml of a 10-fold-diluted tryptic soy broth containing 0.6% yeast extract was added to each coupon (simulating exposure to nutrients during food preparation), and 8 h later each coupon was rinsed with sterile distilled water. Coupons were subjected to sanitiser treatments on days 0, 0.25, 7, 14, and 21. Eight quaternary ammonium compound (QAC)-based sanitisers, one of lactic acid-based sanitiser, and one sodium hypochlorite-based sanitiser were applied to individual coupons according to the manufacturers' instructions. Coupons were analysed for *L. monocytogenes* (PALCAM agar) and total bacteria (tryptic soy agar with 0.6% yeast extract). At 0 and 0.25 days, nine of the sanitisers (all except for QAC-based sanitiser 10) had reduced *L. monocytogenes* to < 0.60 log CFU/cm². For > or = 7-day-old biofilms, the lactic acid-based sanitiser (pH 3.03) was the most effective, and the QAC-based sanitisers were more effective when at pH 10.42 to 11.46 than at pH 6.24 to 8.70. Sanitiser efficacies were greater ($P < 0.05$) against younger (7 days) than older (21 days) biofilms on smooth surfaces. For 7- and 14-day-old biofilms, sanitiser efficacies were higher ($P < 0.05$) on smooth than on rough surfaces.

Inactivation of Avian Influenza Virus Using Four Common Chemicals and One Detergent. Alphin RL, Johnson KJ, Ladman BS, et al. Poult Sci. 2009;88(6):1181-5.

Five disinfectant chemicals were tested individually for effectiveness against low pathogenic avian influenza virus (LPAIV), A/H7N2/Chick/MinhMa/04, on hard, nonporous surfaces. The tested agents included acetic acid, calcium hydroxide, sodium carbonate, sodium hydroxide, and a powdered laundry detergent without bleach. Multiple common chemicals including acetic acid (1 and 3%), sodium hydroxide (2%), and calcium hydroxide (1%) effectively inactivated LPAIV on a metal surface. The laundry detergent without bleach, sodium carbonate (4%), and the lower concentration of sodium hydroxide (1%) were not able to consistently inactivate LPAIV on hard, nonporous surfaces.

Potential Pathogens and Effective Disinfectants on Public Telephones at a Large Urban United States University. Annand JW, Bajaj N, Sheth A, et al. J Environ Health. 2009;71(6):24-8, 48.

Telephones can carry potential bacterial pathogens, posing a risk for transfer of pathogens to users' hands. This study examined 25 mouthpieces of public telephones at a large urban U.S. university located in an area of rising incidence of community-acquired staphylococcal infections. Coagulase-negative staphylococci were most commonly isolated (64% of mouthpieces). Potential pathogens isolated included *Staphylococcus aureus*, vancomycin-susceptible *Enterococcus*, and *Klebsiella ozaenae*. The efficacy of disinfectants on reducing bacterial counts on telephone mouthpieces was also investigated. *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Enterococcus faecalis* were inoculated onto mouthpieces and challenged with disinfectant wipes. Bacterial counts were reduced substantially for all three organisms by wipes containing either 70% isopropyl alcohol, 1.84% sodium hypochlorite, or quaternary ammonium compounds. The sodium hypochlorite-based cleaner demonstrated 100% efficacy at removing or killing test organisms from telephone mouthpieces. These data suggest that tested cleaners may be appropriate and needed for public telephone disinfection.

Comparison of the Efficacy of a Hydrogen Peroxide Dry-Mist Disinfection System and Sodium Hypochlorite Solution for Eradication of *Clostridium difficile* Spores. Barbut F, Menuet D, Verachten M, et al. Infect Control Hosp Epidemiol. 2009 Apr 20. [Epub ahead of print].

This prospective, randomised, before-after trial compared a hydrogen peroxide dry-mist system and a 0.5% hypochlorite solution, with respect to their ability to disinfect *Clostridium difficile*-contaminated surfaces in vitro and in situ, in two French hospitals affected by *C. difficile*. In situ efficacy of disinfectants was assessed in rooms that had housed patients with *C. difficile* infection. A prospective study was performed at 2 hospitals that involved randomisation of disinfection processes. When a patient with *C. difficile* infection was discharged, environmental contamination in the patient's room was evaluated before and after disinfection. Environmental surfaces were sampled for *C. difficile* by use of moistened swabs; swab samples were cultured on selective plates and in broth. Both disinfectants were tested in vitro with a spore-carrier test; in this test, 2 types of material, vinyl polychloride (representative of the room's floor) and laminate (representative of the room's furniture), were experimentally contaminated with spores from three *C. difficile* strains, including the epidemic clone ribotype 027-North American pulsed-field gel electrophoresis type 1. Results showed that there were 748 surface samples collected (360 from rooms treated with hydrogen peroxide and 388 from rooms treated with hypochlorite). Before disinfection, 46 (24%) of 194 samples obtained in the rooms randomised to hypochlorite treatment and 34 (19%) of 180 samples obtained in the rooms randomised to hydrogen peroxide treatment showed environmental contamination. After disinfection, 23 (12%) of 194 samples from hypochlorite-treated rooms and 4 (2%) of 180 samples from hydrogen peroxide treated rooms showed environmental contamination, a decrease in contamination of 50% after hypochlorite decontamination and 91% after hydrogen peroxide decontamination ([Formula: see text]). The in vitro activity of 0.5% hypochlorite was time dependent. The mean (+/-SD) reduction in initial log(10) bacterial count was [Formula: see text] log(10) colony-forming units after 10 minutes of exposure to hypochlorite and [Formula: see text] log(10) colony-forming units after 1 cycle of hydrogen peroxide decontamination. The conclusion was that in situ experiments indicate that the hydrogen peroxide dry-mist disinfection system is significantly more effective than 0.5% sodium hypochlorite solution at eradicating *C. difficile* spores and might represent a new alternative for disinfecting the rooms of patients with *C. difficile* infection.

Susceptibilities of *Bacillus subtilis*, *Bacillus cereus*, and avirulent *Bacillus anthracis* spores to liquid biocides. Hilgren J, Swanson KM, Diez-Gonzalez F, et al. J Food Prot. 2009;72(2):360-4.

The susceptibility of spores of *Bacillus subtilis*, *Bacillus cereus*, and avirulent *Bacillus anthracis* to treatment with hydrogen peroxide, peroxyacetic acid, a peroxy-fatty acid mixture, sodium hypochlorite, and acidified sodium chlorite was investigated. Results indicated that *B. cereus* spores may be reasonable predictors of *B. anthracis* spore inactivation by peroxyacetic acid-based biocides. However, *B. cereus* was not a reliable predictor of *B. anthracis* inactivation by the other biocides. In studies comparing *B. cereus* and *B. subtilis*, *B. cereus* spores were more resistant (by 1.5 to 2.5 log CFU) than *B. subtilis* spores to peroxyacetic acid, the peroxy-fatty acid mixture, and acidified sodium chlorite. Conversely, *B. subtilis* spores were more resistant than *B. cereus* spores to hydrogen peroxide. These findings indicated the relevance of side-by-side testing of target organisms and potential

surrogates against categories of biocides to determine whether both have similar properties and to validate the use of the surrogate microorganisms.

Use of Surgical Face Masks to Reduce the Incidence of the Common Cold Among Health Care workers in Japan: A Randomized Controlled Trial. Jacobs J, Ohde S, Takahashi O, et al.

Healthcare workers outside surgical suites in Asia use surgical-type face masks commonly. Prevention of upper respiratory infection is one reason given, although evidence of effectiveness is lacking. Healthcare workers in a tertiary care hospital in Japan were randomised into 2 groups: 1 that wore face masks and 1 that did not. They provided information about demographics, health habits, and quality of life. Participants recorded symptoms daily for 77 consecutive days, starting in January 2008. Presence of a cold was determined based on a previously validated measure of self-reported symptoms. The number of colds between groups was compared, as were risk factors for experiencing cold symptoms. Thirty-two healthcare workers completed the study, resulting in 2464 subject days. There were 2 colds during this time period, 1 in each group. Of the 8 symptoms recorded daily, subjects in the mask group were significantly more likely to experience headache during the study period ($P < 0.05$). Subjects living with children were more likely to have high cold severity scores over the course of the study. The researchers concluded that face mask use in healthcare workers has not been demonstrated to provide benefit in terms of cold symptoms or getting colds. A larger study is needed to definitively establish noninferiority of no mask use.

Kinetics of Adenovirus Type 2 Inactivation with Free Chlorine. Page MA, Shisler JL, Mariñas BJ. Water Res. 2009 Apr 12. [Epub ahead of print].

The objective of this study was to elucidate the effects of pH, temperature, and other relevant water quality parameters on the kinetics of adenovirus serotype 2 inactivation with free chlorine. Over a pH range of 6.5-10, a temperature range of 1-30 degrees C, and in a variety of water types, free chlorine was highly effective against adenovirus type 2. Its disinfection efficacy decreased with increasing pH and decreasing temperature, yet was unaffected by hardness and buffering species. Under the most challenging conditions investigated in this study (pH 10, 1 degrees C), a four-log reduction of adenovirus viability would be achieved at a CT value of 2.6mgCl(2)min/L. The inactivation kinetics was characterised by three phases of inactivation under most conditions. The first phase resulted from a reaction involving primarily the hypochlorous acid species and was characterised by rapid inactivation of viruses to a limit that increased with decreasing pH and increasing temperature. After reaching this limit, adenovirus exhibited two subsequent phases of inactivation at lesser rates that were not affected by temperature or pH. As with the first phase of kinetics, a limit of inactivation was approached in the second phase that decreased with increasing pH, and after which the kinetics was characterised by a third and final phase. An inactivation model consistent with these observations was found to provide adequate representation for the free chlorine inactivation of adenovirus serotype 2 as well as that reported in the literature for other adenovirus serotypes.

The Effect of Cyanuric Acid on the Disinfection Rate of Cryptosporidium Parvum in 20-ppm free chlorine. Shields JM, Arrowood MJ, Hill VR, et al. J Water Health. 2009;7(1):109-14.

Cyanuric acid is used to stabilise free chlorine to reduce photodegradation in outdoor swimming pools. While there have been numerous studies examining its effect on the disinfection rates of bacteria and viruses, it is not known whether cyanuric acid can significantly impact the effectiveness of hyperchlorination for inactivating *Cryptosporidium* oocysts present in faecally-contaminated swimming pools. This study examined the effect of cyanuric acid on the disinfection rate of *Cryptosporidium parvum* under swimming pool hyperchlorination conditions (20 mg/ml free chlorine). When 50 mg/L cyanuric acid was present there was a 0.70-log₁₀ reduction in oocyst viability after 10 hours as compared to a 3.7-log₁₀ reduction without cyanuric acid. Aids to remediation, such as decreasing the pH to enhance the germicidal efficiency of the free chlorine and doubling the amount of free chlorine residual, were still unable to achieve a 3-log₁₀ reduction. Current public health recommendations for hyperchlorination and pool remediation are insufficient for pools using cyanurate-stabilised chlorine to achieve a three log inactivation of the parasite.

Evaluation of Alcohol Wipes Used During Aseptic Manufacturing. Panousi MN, Williams GJ, Girdlestone S, et al. Letters in Applied Microbiology. 2009;48:648–51.

During aseptic manufacturing and specifically during the transfer of items into an isolator, disinfection of surfaces is essential for reducing the risk of final product contamination. Surface disinfection can be carried out by a variety of methods, however the most accepted current practice is a combination of spraying with 70% alcohol and wiping. The aim of this study was to evaluate the effectiveness of two wipe systems by determining their ability to remove, kill and transfer bacterial contaminants from standardised surfaces. The protocol used to achieve these objectives was based on a newly published method specifically designed to test wipes. Alcohol impregnated wipes performed better at reducing microbial bioburden than the alcohol spray/dry wipe applications. Impregnated wipes drastically reduced (1–2 log₁₀ reduction) a small bioburden (approx. 2 log₁₀) of spores of *Bacillus subtilis* and methicillin-resistant *Staphylococcus aureus* from the surface, but failed to remove (<0.2 log₁₀ reduction) *Staphylococcus epidermidis*. The alcohol spray/dry wipes did not manage to remove (<0.2 log₁₀ reduction) spore or bacterial bioburden from surfaces and was able to transfer some viable microorganisms to other surfaces. Both wipe types showed poor antimicrobial efficacy (<1 log₁₀ reduction) against the test bacteria and spores. As far as the authors are aware this is the first time that such a practical study has been reported and their results suggest that the best wipes for surface disinfection in aseptic units are the alcohol (IPA) impregnated wipes when compared with the dry wipes sprayed with alcohol. The impregnated wipes performed better than the dry wipes sprayed with alcohol and should be used for surface disinfection in aseptic units.

Evaluation of Murine Norovirus as a Surrogate for Human Norovirus and Hepatitis A Virus in Heat Inactivation Studies. Hewitt J, Rivera-Aban M, Greening GE. J Appl Microbiol. 2009;107:65-71.

The objective of this study was to determine the suitability of murine norovirus (MNV) as a surrogate for human norovirus (HuNoV) in heat inactivation studies. MNV, hepatitis A virus (HAV) and HuNoV genogroup I and II (GI and GII) specific real-time quantitative reverse transcription (qRT)-PCR assays were used to determine the effects of heat exposure (63 and 72°C) for up to 10 min in water and milk. Using culture assays, MNV and HAV showed similar reductions in infectivity over time. Both HuNoV GI and GII showed lower log reductions in qRT-PCR titre following heat exposure than either MNV or HAV. No significant protective effect of milk was observed for any virus. The conclusions were that MNV is as suitable a surrogate for HuNoV as HAV. In heat inactivation studies at 63 and 72°C, qRT-PCR results indicate that HuNoV is less susceptible to heat than either HAV or MNV and so neither virus may be an appropriate surrogate for HuNoV. Caution should be used when extrapolating surrogate virus data for HuNoV. Although not conclusive, our results suggest that HuNoV may be more resistant to heat than either HAV or MNV.

Evaluation of Efficacy of Disinfectants Against *Salmonella* from the Feed Industry. Møretre T, Vestby LK, Nesse LL, et al. J Appl Microbiol. 2009;106:1005-12.

The aim of this study was to evaluate disinfectants against *Salmonella* under conditions relevant for the feed industry. A survey on the use of disinfectants in the feed industry showed that a range of different types was used. Nine disinfectants, reflecting the most commonly used active ingredients, were tested for bactericidal activity on *Salmonella* isolated from the feed industry. All disinfectants were efficient against *Salmonella* in suspension. The bactericidal effect varied considerably between different types of active compounds on bacteria dried on surfaces or grown as biofilm. Tenside-based disinfectants and hypochlorite were found to have low bactericidal activity and the efficiency was significantly reduced when the ratio of amount disinfectant per cell decreased. It was shown that concentrations of 70–80% ethanol were effective against *Salmonella*. Among the disinfectants tested a product containing 70% ethanol was most efficient followed by Virkon S. The conclusion was that many disinfectants had low bactericidal activity against *Salmonella* at surfaces while Virkon S and a product containing 70% ethanol were most effective. Another advantage of ethanol-based disinfectants is evaporation of ethanol, resulting in low residual water after use. Use of the disinfectants found to be efficient against surface associated *Salmonella*, may assist the industry in combating *Salmonella*.

Impact of Solar Radiation in Disinfecting Drinking Water Contaminated with *Giardia duodenalis* and *Entamoeba histolytica/dispar* at a Point-of-Use Water Treatment.

Mtapuri-Zinyowera S, Midzi N, Muchaneta-Kubara CE, et al. J Appl Microbiol. 2009;106:847-52.

The aim of this study was to determine the impact of natural sunlight in disinfecting water contaminated with cysts of *Giardia duodenalis* and *Entamoeba histolytica/dispar* using plastic containers. Known quantities of *Giardia duodenalis* and *Entamoeba histolytica/dispar* cysts in sterile water were exposed to the sun. Containers were made of polyethylene terephthalate, eight painted black on one side, one not painted and another cut open at the top and the last was a high density polypropylene container. Viability testing was performed using vital and fluorescent dyes. The same assays were conducted under cloudy conditions. Thermal control tests were also performed using heat without ultra violet light from the sun. Results show that 99.9% of parasites were inactivated when water temperatures reached 56°C after sunlight exposure. It was concluded that both solar radiation and heat produced by the sun have a synergistic effect in killing cysts of *Giardia duodenalis* and *Entamoeba histolytica/dispar* when temperatures rise above 50°C, with complete death at 56°C, using painted 2-l PET containers. A solar disinfection system using PET containers painted black on one side can be used to disinfect water against *Giardia duodenalis* and *Entamoeba histolytica/dispar* using natural sunlight.

Characterization of Bacterial Strains Isolated from a Beef Processing Plant Following Cleaning and Disinfection - Influence of Isolated Strains on Biofilm Formation by Sakai and EDL 933 *E. coli* O157:H7. Marouani-Gadri N, Augier G, Carpentier B. Int J Food Microbiol. 2009. doi:10.1016/j.ijfoodmicro.2009.04.028.

The objective of this study was to investigate the effects on *E. coli* O157:H7 biofilm formation of bacteria isolated from meat site surfaces following cleaning and disinfection. The researchers first isolated and identified strains of the latter organisms. Samples were obtained by swabbing the surfaces of equipment or floors over areas ranging from 315 to 3,200 cm² in a slaughter hall, a meat cutting room and a meat boning room of a processing plant. The number of bacteria recovered from these surfaces ranged from < 1 to > 105 CFU/cm². In the slaughter hall, stainless steel was, in one case, one of the most contaminated materials and in other cases one of the least contaminated. The same observation was made for conveyor belts made of polyvinyl chloride in the boning room. Dominant genera in the meat plant were *Staphylococcus* and *Bacillus* which were both 34% of the isolates from the slaughter hall and 14 and 4% respectively of the isolates from the cutting room. Randomly selected isolates of each of the genera recovered from the slaughter hall were cultured with *E. coli* O157:H7 in meat exudate at 15°C to form dual-organism biofilms on polyurethane. In all cases but one, the isolates increased the numbers of attached *E. coli* O157:H7. The effects ranged from 0.37 to 1.11 for EDL 933 strain and from 0.19 to 1.38 log (CFU/cm²) for Sakai strain. This is the first time that a resident microbiota of a meat processing plant has been shown to have a favourable effect on *E. coli* O157:H7 colonization of a solid surface, which is of great interest from a food safety standpoint.

Efficacy of soap and water and alcohol-based hand-rub preparations against live H1N1 influenza virus on the hands of human volunteers. Grayson ML, Melvani S, Druce J, Barr IG, Ballard SA, Johnson PD, Mastorakos T, Birch C. Clin Infect Dis. 2009 Feb 1;48(3):285-91.

Twenty health care workers had their hands contaminated with 1 mL of 10(7) TCID₅₀/0.1 mL live human influenza A virus before undertaking HH protocols (no HH [control], soap and water hand washing [SW], use of alcohol-based hand rubs [61.5% ethanol gel, 70% ethanol plus 0.5% chlorhexidine solution, or 70% isopropanol plus 0.5% chlorhexidine solution]). H1N1 concentrations were assessed before and after each intervention by viral culture and PCR. There was an immediate reduction in culture-detectable and PCR-detectable H1N1 after brief cutaneous air drying--14 of 20 health care workers had H1N1 detected by means of culture (mean reduction, 10(3-4) TCID₅₀/0.1 mL), whereas 6 of 20 had no viable H1N1 recovered; all 20 health care workers had similar changes in PCR test results. Marked antiviral efficacy was noted for all 4 HH protocols, on the basis of culture results (14 of 14 had no culturable H1N1; (P< .002) and PCR results (P< .001), with SW statistically superior (P< .001) to all 3 alcohol-based hand rubs, although the actual difference was only 1-100 virus copies/microL. There was minimal reduction in H1N1 after 60 min without HH. The authors conclude that HH with SW or alcohol-based hand rub is highly effective in reducing influenza A virus on human hands, although SW is the most effective intervention.

Topic 4: Hygiene Intervention Studies

Sustained Hand Hygiene Initiative Reduces MRSA Transmission. Ancona RJ, Boehler R, Chapman LA. *J Clin Outcomes Manage.* 2009;16(4):167-70.

An institution-wide hand hygiene programme was developed in a US medical centre that included monitoring, recording observations, and providing personnel with regular feedback. Hand hygiene compliance improved and was sustained at over 90% during a 3-year time frame with a concomitant reduction in healthcare-associated MRSA.

The Association Between Handwashing Practices and Illness Symptoms among College Students Living in a University Dormitory. Thumma J, Aiello A, Foxman B. *AJIC.* 2009;37(1):70-2.

The researchers describe handwashing practices, the association of handwashing with upper respiratory and gastrointestinal symptoms, and the effects of gender on handwashing practices among male (n = 215) and female (n = 243) college students. Self-reported frequency of handwashing was not associated with infectious illness symptom reporting. Only a small proportion of males (10%) and females (7%) reported "always" washing their hands before eating. Females were more likely than males to always wash their hands after urinating (69% vs 43%; $P < 0.0001$) and after a bowel movement (84% vs 78%; $P = 0.14$). Identifying new strategies to increase handwashing may help prevent infectious disease transmission in residence hall environments.

Effect of Hand Hygiene on Infectious Disease Risk in the Community Setting: A Meta-Analysis. Aiello AE, Coulborn RM, Perez V, et al. *Am J Public Health.* 2008;98:1372-81. doi:10.2105/AJPH.2007.124610.

To quantify the effect of hand-hygiene interventions on rates of gastrointestinal and respiratory illnesses and to identify interventions that provide the greatest efficacy, the researchers studied four electronic databases for hand-hygiene trials published from January 1960 to May 2007 and conducted meta-analyses to generate pooled rate ratios across interventions (N=30 studies). Improvements in hand hygiene resulted in reductions in gastrointestinal illness of 31% (95% confidence intervals [CI]=19%, 42%) and reductions in respiratory illness of 21% (95% CI=5%, 34%). The most beneficial intervention was hand-hygiene education with use of nonantibacterial soap. Use of antibacterial soap showed little added benefit compared with use of nonantibacterial soap. Hand hygiene is clearly effective against gastrointestinal and, to a lesser extent, respiratory infections. Studies examining hygiene practices during respiratory illness and interventions targeting aerosol transmission are needed.

Preliminary Findings of a Randomized Trial of Non-Pharmaceutical Interventions to Prevent Influenza Transmission in Households. Cowling BJ, Fung ROP, Cheng CKY, et al. *PLoS ONE* 3(5): e2101. doi:10.1371/journal.pone.0002101.

This trial studied the feasibility and efficacy of face masks and hand hygiene to reduce influenza transmission among Hong Kong household members. A cluster randomised controlled trial of households was conducted where an index subject presented with influenza-like-illness of 48 hours duration. After influenza was confirmed in an index case by the QuickVue Influenza A+B rapid test, the household of the index subject was randomised to 1) control or 2) surgical face masks or 3) hand hygiene. Households were visited within 36 hours, and 3, 6 and 9 days later. Nose and throat swabs were collected from index subjects and all household contacts at each home visit and tested by viral culture. The primary outcome measure was laboratory culture confirmed influenza in a household contact; the secondary outcome was clinically diagnosed influenza (by self-reported symptoms). There were 21 household contacts with laboratory confirmed influenza corresponding to a secondary attack ratio of 6%. Clinical secondary attack ratios varied from 5% to 18% depending on case definitions. The laboratory-based or clinical secondary attack ratios did not significantly differ across the intervention arms. Adherence to interventions was variable. The secondary attack ratios were lower than anticipated, and lower than reported in other countries, perhaps due to differing patterns of susceptibility, lack of significant antigenic drift in circulating influenza virus strains recently, and/or issues related to the symptomatic recruitment design. Lessons learnt from this pilot have informed changes for the main study in 2008.

Risk Factors for Sporadic *Campylobacter* Infection: an all-Ireland Case-Control study. Danis K, Di Renzi M, O'Neill W, et al. Eurosurveillance. 2009;14(7):1-8.

This article reports on the findings of the first case-control study conducted in both the Republic of Ireland and Northern Ireland to determine risk factors for sporadic *Campylobacter* infections. A total of 197 cases and 296 case-nominated controls matched for age, were included. Based on Population Attributable Fraction (PAF), the most important risk factors were consuming chicken [adjusted matched (am) OR 6.8; 95%CI 2.1-21.9], consuming lettuce (amOR 3.3; 95%CI 1.5-7.1) and eating in takeaways (amOR=3.1; 95%CI 1.4-6.6). Contact with sheep (amOR=11; 95%CI 1.6-78), peptic ulcer (amOR=19; 95%CI 3.8-93.7), hiatus hernia (amOR=20.3; 95%CI 2.3-183.3), lower bowel problems (amOR=4.5; 95%CI 1.2-16.8) were also independently associated with infection. Mains water supply showed protective effect (amOR=0.2; 95 CI 0.1-0.9). The findings highlight the continued need for consumer food safety education and further control measures throughout the food chain on the island of Ireland.

Face Mask Use and Control of Respiratory Virus Transmission in Households. Raina MacIntyre C, Cauchemez S, Dwyer DE, et al. Emerg Infect Dis. 2009;15(2):233-41.

Many countries are stockpiling face masks for use as a nonpharmaceutical intervention to control virus transmission during an influenza pandemic. The researchers conducted a prospective cluster-randomized trial comparing surgical masks, non-fit-tested P2 masks, and no masks in prevention of influenzalike illness (ILI) in households. Mask use adherence was self-reported. During the 2006 and 2007 winter seasons, 286 exposed adults from 143 households who had been exposed to a child with clinical respiratory illness were recruited. The researchers found that adherence to mask use significantly reduced the risk for ILI-associated infection, but <50% of participants wore masks most of the time. They concluded that household use of face masks is associated with low adherence and is ineffective for controlling seasonal respiratory disease. However, during a severe pandemic when use of face masks might be greater, pandemic transmission in households could be reduced.

Physical Interventions to Interrupt or Reduce the Spread of Respiratory Viruses: Systematic Review. Jefferson T, Foxlee R, Del Mar C, et al. BMJ. 2008;336:77-80.

The objective of this study was to systematically review the published evidence for the effectiveness of physical interventions to interrupt or reduce the spread of respiratory viruses. Of 2,300 titles scanned, 138 full papers were retrieved, including 49 papers of 51 studies. The highest quality cluster randomised trials suggest that the spread of respiratory viruses into the community can be prevented by intervening with hygienic measures aimed at younger children. Meta-analysis of six case-control studies suggests that physical measures are highly effective in preventing the spread of SARS: handwashing more than 10 times daily; wearing masks; wearing N95 masks; wearing gloves; wearing gowns and, handwashing, masks, gloves, and gowns combined. The incremental effect of adding virucidals or antiseptics to normal handwashing to decrease the spread of respiratory disease remains uncertain. The lack of proper evaluation of global measures such as screening at entry ports and social distancing prevent firm conclusions being drawn. The conclusions were that routine long-term implementation of some physical measures to interrupt or reduce the spread of respiratory viruses might be difficult but many simple and low cost interventions could be useful in reducing the spread.

Hospital Infection Control Strategies for Vancomycin-resistant *Enterococcus*, Methicillin-Resistant *Staphylococcus aureus* and *Clostridium difficile*. Johnston BL and Bryce E. CMAJ. 2009;180(6):627-31.

Antimicrobial resistance is an increasing problem and challenge worldwide. Methicillin-resistant *Staphylococcus aureus* (MRSA) is the most commonly identified antimicrobial-resistant pathogen in areas of the world where these data are available. Rates of MRSA among clinical isolates of *S. aureus* vary from less than 1% in Norway and Sweden, 5%–10% in Canada, 25%–50% in the United States, to more than 50% in Hong Kong and Singapore. In a multinational survey of nosocomial pathogens, none of the clinical enterococcal isolates from South Africa, Egypt, Saudi Arabia or Lebanon were vancomycin-resistant enterococci. However, 7% of isolates from Germany and 16.7% of isolates from Switzerland and Greece were vancomycin-resistant enterococci. Resistance among these pathogens is much more prevalent among nosocomial infections than among community-acquired infections. The hypervirulent strain of *Clostridium difficile*, identified as a cause of outbreaks in North

America, has been detected in an increasing number of European countries, affecting hospitals in 11 European Union member states and Switzerland. Four key hospital interventions – hand hygiene, environmental cleaning, barrier precautions and screening – are the cornerstones of infection control. In this article, the researchers review the current knowledge and best practices in these areas.

Topic 5: Promoting Behaviour change

Can the Emotion of Disgust be Harnessed to Promote Hand Hygiene?: Experimental and Field-based Tests. Porzig-Drummonda R, et al. Social Science & Medicine. 2009;68:1006-12.

Two studies carried out in Sydney, Australia explored whether inducing disgust may be a useful addition to hand-hygiene interventions. Experiment 1 tested whether a brief (3-min) video-based intervention using disgust/education, improved hand hygiene relative to education alone and a control condition. On test, a week later, the disgust intervention significantly exceeded the education and control condition combined, although the effect size was modest. In Experiment 2, during a baseline period, soap and paper towel use in a series of washrooms were covertly monitored. This was followed by an intervention period, in which 2 washrooms received disgust/education-based posters and a further two, educational posters, exhorting participants to wash their hands. The disgust-based intervention was significantly better at promoting hand hygiene.

The Global Impact of Hand Hygiene Campaigning. Kilpatrick C, Allegranzi B, Pittet D. Eurosurveillance. 2009;14(17).

This editorial outlines the WHO "Save Lives, Clean Your Hands" campaign and other initiatives aimed to promote and support the promotion of hand hygiene.

Planned, Motivated and Habitual Hygiene Behaviour: An Eleven Country Review. Curtis VA, Danquah LO, Anger RV. Health Educ Res. 2009;24(4):655-73. Epub 2009 Mar 13.

Handwashing with soap (HWWS) may be one of the most cost-effective means of preventing infection in developing countries. The researchers reviewed the results of formative research studies from 11 countries so as to understand the planned, motivated and habitual factors involved in HWWS. On average, only 17% of child caretakers HWWS after the toilet. Handwash 'habits' were generally not inculcated at an early age. Key 'motivations' for handwashing were disgust, nurture, comfort and affiliation. Fear of disease generally did not motivate handwashing, except transiently in the case of epidemics such as cholera. 'Plans' involving handwashing included to improve family health and to teach children good manners. Environmental barriers were few as soap was available in almost every household, as was water. Because much handwashing is habitual, self-report of the factors determining it is unreliable. Candidate strategies for promoting HWWS include creating social norms, highlighting disgust of dirty hands and teaching children HWWS as good manners. Dividing the factors that determine health-related behaviour into planned, motivated and habitual categories provides a simple, but comprehensive conceptual model.

Difficulties in Maintaining Improved Handwashing Behavior, Karachi, Pakistan. Luby SP, Agboatwalla M, Bowen A, et al. Am J Trop Med Hyg. 2009;81(1):140-5.

In an earlier study in Karachi, Pakistan, households that received free soap and handwashing promotion for 9 months reported 53% less diarrhoea than controls. Eighteen months after the intervention ended, these households were enrolled in a follow-up study to assess sustainability of handwashing behaviour. Upon re-enrollment, mothers in households originally assigned to the intervention were 1.5 times more likely to have a place with soap and water to wash hands (79% versus 53%, $P = 0.001$) and when asked to wash hands were 2.2 times more likely to rub their hands together at least three times (50% versus 23%, $P = 0.002$) compared with controls. In the ensuing 14 months, former intervention households reported a similar proportion of person-days with diarrhoea (1.59% versus 1.88%, $P = 0.66$) as controls. Although intervention households showed better handwashing technique after 2 years without intervention, their soap purchases and diarrhoea experience was not significantly different from controls.

A Pilot Study Describing Infant Formula Preparation and Feeding Practices. Herbold NH, Scott E. Int J Environ Health Res. 2008;18(6):451-9.

Foodborne illnesses pose a problem to all individuals but are especially significant for infants. This observational study collected pilot data on formula preparation practices of 15 mothers of infants under the age of 7 months. A site survey tool was developed, based upon existing instruments. A trained observer travelled to the participants' homes to observe formula preparation and feeding. Some 73% of women did not wash their hands before preparing formula, 60% did not keep the prepared bottle cool during transport away from home, 53% checked the formula expiration date, 20% of infants slept with their bottle, 47% added cereal to formula, and 36% obtained information about formula preparation from a health professional. Hand washing is one of the most important home hygiene practices; however, hand washing practices by participants in this study prior to baby bottle preparation was poor.

Topic 6: Biocides and antimicrobial resistance

Factors Affecting the Reversal of Antimicrobial Drug Resistance. Johnsen PJ, Townsend JP, Bøhn T, et al. Lancet Infect Dis. 2009;9(6):357-64.

The persistence or loss of acquired antimicrobial-drug resistance in bacterial populations previously exposed to drug-selective pressure depends on several biological processes. The researchers review mechanisms promoting or preventing the loss of resistance, including rates of reacquisition, effects of resistance traits on bacterial fitness, linked selection, and segregational stability of resistance determinants. As a case study, we discuss the persistence of glycopeptide-resistant *enterococci* in Norwegian and Danish poultry farms 12 years after the ban of the animal growth promoter avoparcin. The researchers concluded that complete eradication of antimicrobial resistance in bacterial populations following relaxed drug-selective pressures is not straightforward. Resistance determinants may persist at low, but detectable, levels for many years in the absence of the corresponding drugs.

Sensitivities to Biocides and Distribution of Biocide Resistance Genes in Quaternary Ammonium Compound Tolerant Staphylococcus Aureus Isolated in a Teaching Hospital. Liu Q, Liu M, Wu Q, et al. Scand J Infect Dis. 2009 Apr 7:1-7. [Epub ahead of print].

In this study, the minimum bactericidal concentrations (MBCs) of 5 biocides (benzalkonium chloride, glutaraldehyde, sodium hypochlorite, povidone iodine and ethanol) for 56 clinical quaternary ammonium compound (QAC) tolerant *S. aureus* strains following exposure for 5, 30 or 180 min, collected from a teaching hospital in China, were examined. The distributions of the biocide resistance genes *qacA/B*, *smr*, *qacH* and *qacG* were investigated by polymerase chain reaction. Following 5 min exposure of benzalkonium chloride and povidone iodine, 7.1% (4/56) and 7.1% (4/56) isolates, respectively, exhibited MBC values higher than their in-use concentrations for mucosa and wound disinfection. The MBC values of all the isolates studied for glutaraldehyde, sodium hypochlorite and ethanol were lower than the in-use concentrations in all contact times. The *qacA/B* gene was found in 94.6% (53/56) of QAC tolerant *S. aureus*. The frequencies of *smr* (3.6%, 2/56) and *qacH* (7.1%, 4/56) were low and *qacG* was not detected. The results suggested that clinical QAC tolerant *S. aureus* isolates of China had the possibility to survive in proper in-use concentrations of some biocides at proper contact time, and *qacA/B* is the most prevalent disinfectant resistant gene in this type of bacteria.

Triclosan-Tolerant Bacteria: Changes in Susceptibility to Antibiotics. Cottell A, Denyer SP, Hanlon GW, et al. © 2009 The Hospital Infection Society. Published by Elsevier Ltd. All rights reserved.

There is no clear consensus regarding the effect of biocide tolerance on antibiotic susceptibility. In this work, triclosan-tolerant strains of *Escherichia coli*, *Staphylococcus aureus* and *Acinetobacter johnsonii* were compared with sensitive strains in order to ascertain their susceptibility to a range of antibiotics. The minimum inhibitory concentrations of triclosan were measured using broth- and agar-dilution techniques. Antibiotic susceptibilities were determined using the British Society for Antimicrobial Chemotherapy guidelines. No triclosan-tolerant strains were resistant to antibiotics, and there was no overall tendency for triclosan-tolerant strains to have significantly smaller zones of inhibition compared with counterpart strains. Triclosan-tolerant strains of *E. coli* were significantly more susceptible to aminoglycoside antibiotics. The mechanism by which *E. coli* develops tolerance to triclosan appears to be linked to aminoglycoside susceptibility. It is proposed that changes in outer membrane, or the loss of plasmids, may be responsible for this relationship.

Topic 7: Hygiene Hypothesis

Spontaneous Cytokine Production in Children According to Biological Characteristics and Environmental Exposures. Figueiredo CA, Alcântara-Neves NM, Veiga R, et al. Environ Health Perspect. 2009;117:845-9.

The study measured T helper (Th) 1 (interferon-gamma), Th2 [interleukin (IL) -5 and IL-13], and the regulatory cytokine IL-10 in unstimulated peripheral blood leukocytes from 1,376 children 4–11 years of age living in a poor urban area of the tropics. It also assessed the impact of environmental exposures in addition to biological characteristics recorded at the time of blood collection and earlier in childhood (0–3 years before blood collection). The proportion of children producing IL-10 was greater among those without access to drinking water. The proportion of children producing IL-5 and IL-10 was significantly greater in households that had never had a sewage system. These data provide evidence for the profound effects of environmental exposures in early life as well as immune homeostasis in later childhood. Decreased hygiene (lack of access to clean drinking water and sanitation) in the first 3 years of life is associated with higher spontaneous IL-10 production up to 8 years later in life.

Inverse Associations of *Helicobacter pylori* with Asthma and Allergy. Chen Y, Blaser MJ. Arch Intern Med. 2007;167(8):821-7.

The study evaluated the associations of *H pylori* status with history of asthma and allergy and with skin sensitisation using data from 7663 adults. Adjusted odds ratios (ORs) for currently and ever having asthma, allergic rhinitis, allergy symptoms in the previous year, and allergen-specific skin sensitisation were computed comparing participants seropositive for *cagA*⁻ or *cagA*⁺ strains of *H pylori* with those without *H pylori*. The presence of *cagA*⁺ *H pylori* strains was inversely related to ever having asthma, and the inverse association of *cagA* positivity with childhood-onset (age 15 years) asthma was stronger than that with adult-onset asthma. Colonisation with *H pylori*, especially with a *cagA*⁺ strain, was inversely associated with currently or ever having a diagnosis of allergic rhinitis, especially for childhood onset. Consistent inverse associations were found between *H pylori* colonisation and the presence of allergy symptoms in the previous year and sensitisation to pollens and molds. The observations support the hypothesis that childhood acquisition of *H pylori* is associated with reduced risks of asthma and allergy.

Review Series on Helminths, Immune Modulation and the Hygiene Hypothesis: The Broader Implications of the Hygiene Hypothesis. Rook GA. Immunology. 2009;126(1):3-11. Review.

Man has moved rapidly from the hunter-gatherer environment to the living conditions of the rich industrialised countries. The hygiene hypothesis suggests that the resulting changed and reduced pattern of exposure to microorganisms has led to disordered regulation of the immune system, and hence to increases in certain inflammatory disorders. The concept began with the allergic disorders, but there are now good reasons for extending it to autoimmunity, inflammatory bowel disease, neuroinflammatory disorders, atherosclerosis, depression associated with raised inflammatory cytokines, and some cancers. This review discusses these possibilities in the context of Darwinian medicine, which uses knowledge of evolution to cast light on human diseases. The Darwinian approach enables one to correctly identify some of the organisms that are important for the 'Hygiene' or 'Old Friends' hypothesis, and to point to the potential exploitation of these organisms or their components in novel types of prophylaxis with applications in several branches of medicine.

Intestinal Microbiota Gives a Nod to the Hygiene Hypothesis in Type 1 Diabetes. Dessein R, Peyrin-Biroulet L, Chamailard M. Nature. 2008;455(7216):1109-13.

Abstract not available

Probiotics and Prebiotics in Atopic Dermatitis: Review of the Theoretical Background and Clinical Evidence. van der Aa LB, Heymans HS, van Aalderen WM, et al. Pediatr Allergy Immunol. 2009 Jul 2. [Epub ahead of print].

The prevalence of atopic dermatitis (AD) has risen over the past decades, especially in western societies. According to the revised hygiene hypothesis this increase is caused by a changed intestinal colonisation pattern during infancy, which has an impact on the immune

system. Manipulating the intestinal microflora with pro-, pre- or synbiotics is an innovative way to prevent or treat AD. This review provides an overview of the theoretical basis for using probiotics and prebiotics in AD and presents the current evidence from randomised controlled trials (RCTs) regarding prevention and treatment of AD and food allergy in children with pro-, pre- and synbiotics. Seven RCTs on prevention and 12 RCTs on treatment were found by searching the Pubmed, Embase and Cochrane databases. Results of these trials are conflicting. In conclusion, at this moment there is not enough evidence to support the use of pro-, pre- or synbiotics for prevention or treatment of AD in children in clinical practice

Microbial Exposure, Interferon Gamma Gene Demethylation in Naïve T-cells, and the Risk of Allergic Disease. Vuillermin PJ, Ponsonby A-L, Saffery R, et al. *Allergy*. 2009;64(3):348-53.

The period of immune programming during early life presents a critical window of opportunity for the prevention of allergic diseases. There is mounting evidence that inappropriate immune programming may involve disruption of specific epigenetic modifications (switches) at immune-related genes. This novel area of research has great potential, as epigenetic changes are known to be sensitive to environmental factors and may therefore provide a mechanistic link for the observed association between specific environmental cues, faulty immune development, and the risk of allergic disease. In addition, the dynamic and potentially reversible nature of epigenetic modifications offers potentially novel targets for therapeutic and/or preventative interventions. The researchers review the evidence that failure to up-regulate the interferon gamma (IFN γ) response during infancy is an important determinant of the risk of allergic disease, expression of the IFN γ gene in naïve T-cells is regulated by epigenetic mechanisms, and failure to up-regulate IFN γ gene expression of naïve T-cells associated with low early life microbial exposure. Taken together, these lines of evidence suggest that low microbial exposure during early life increases the risk of allergic disease by reducing demethylation (activation) of the IFN γ gene of naive T-cells.

Role of Respiratory Viral Infections in the Development of Atopic Conditions. Walton RP, Johnston SL. *Curr Opin Allergy Clin Immunol*. 2008;8(2):150-3.

Respiratory viral infections are implicated in both protection from, and inception of, allergic airway disease. Severe lower respiratory tract viral infections are associated with recurrent wheeze, asthma and atopy. It is unclear if this association is causal and the underlying mechanisms governing this are unknown. Whilst respiratory viral infections are the major precipitants of acute exacerbations of wheezing illness, early life infections are also clearly associated with protection from allergic diseases. This article aims to review the current understanding of the complex relationship between lower respiratory tract viral infections and their impact upon development of atopy in the airway. RECENT FINDINGS: Clinical studies and animal models have further demonstrated that lower respiratory tract viral infections are strongly associated with development of recurrent wheeze and asthma with human rhinoviruses being shown to be the most prevalent cause of lower respiratory tract viral infections in infants, along with associated asthma development. A case-control study provided evidence of a contributory role for respiratory viral infections within this association, whilst recent experimental studies provide a possible mechanistic insight. SUMMARY: Progress into understanding the relationship between respiratory viral infections and allergic airway disease is essential for development of treatments aimed at treating common risk factors mediating association but not cause. Recent findings may have begun to identify key pathways open to therapeutic intervention.

Early Daycare: More Airway Symptoms Early in Life, No Prevention of Asthma Symptoms or Atopy at 8 Years. Caudri D, Wijga A, Scholtens S, et al. *Am J Respir Crit Care Med*. 2009. doi:10.1164/rccm.200903-0327OC

Daycare exposes young children to more infections early in life, and may thereby prevent the development of asthma and allergy. The objective was to prospectively study the effect of daycare on the development of asthma and allergic sensitisation during the first 8 years of life. In the PIAMA birth cohort 3963 newborn children were followed prospectively for 8 years. Daycare use and respiratory health were assessed yearly by questionnaires. At 8 years, sensitisation to airborne allergens and airway responsiveness were measured. Daycare was defined as early (age 0-2), late (age 2-4) or none (no daycare before age 4). Associations of daycare 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. The results demonstrated that children with early daycare had more wheezing in the first years of life, but less wheezing and steroid use between 4 and 8 years. At 8 years, early daycare was not protective for asthma symptoms (adjusted odds ratio, aOR 0.99, 95% CI 0.74-1.32), allergic sensitisation (aOR 0.86, 0.63-1.18) or airway hyperresponsiveness (aOR 0.80, 0.57-1.14). The transient reduction in airway symptoms between age 4 and 8 years was only observed in children without older siblings. The conclusions drawn were that Conclusion: eEarly daycare is associated with an increase in airway symptoms until the age of 4, and fewer symptoms between 4 and 8 years. WeThe researchers found no protection against asthma symptoms, hyperresponsiveness or allergic sensitization at the age of 8 years.

Do Childhood Respiratory Infections Continue to Influence Adult Respiratory Morbidity? Dharmage SC, Erbas B, Jarvis D, et al. Eur Respir J. 2009;33:237-44.

The aim of this study was to examine the influence of childhood respiratory infections on adult respiratory health. In 1992–1994, the European Community Respiratory Health Survey recruited community based samples of 20–44-yr-old people from 48 centres in 22 countries. Study participants completed questionnaires and underwent lung function testing. On average, 8.9 yrs later, 29 centres re-investigated their samples using similar methods. Mixed effects models comprising an estimate for the random variation between centres were used to evaluate the relevant associations. In total, 9,175 patients participated in both studies, of whom 10.9% reported serious respiratory infections (SRI) before 5 yrs of age and 2.8% reported hospitalisation for lung disease (HLD) before 2 yrs if age. SRI was associated with current wheeze (odds ratio (OR) 1.9, 95% confidence interval (CI) 1.7–2.2), asthma (OR 2.5, 95% CI 2.2–3.1), and lower forced expiratory volume in one second (FEV₁; 89 mL; 95% CI 54–126), forced vital capacity (FVC; 49 mL; 95% CI 8–90) and FEV₁/FVC ratio (–1.2%; 95% CI –1.8– –0.6). Childhood respiratory infections were also associated with new asthma (OR 1.5, 95% CI 1.03–2.0), new wheeze (OR 1.5, 95% CI 1.0–2.4) and persistent wheeze (OR 2.2, 95% CI 1.4–3.6) but not with a decline in lung function. Similar findings were observed for HDL. These associations were significantly consistent across centres. SRI was associated with lower FEV₁ when excluding ever asthmatics and current wheezers. The impact of early infections was significantly larger in subjects exposed to maternal or active smoking. The impact of childhood respiratory infections on the respiratory system may not only last into adulthood but also influence development and persistence of adult respiratory morbidity.

Mold Exposure During Infancy as a Predictor of Potential Asthma Development. Iossifova YY, Reponen T, Ryan PH, et al. Ann Allergy Asthma Immunol. 2009;102(2):131-7.

Exposure to mold has been associated with exacerbation of asthma symptoms in children. This article reports on how the presence of visible mold and exposure to (1-3)- β -D-glucan in infancy affects the risk of asthma at the age of 3 years as defined by an Asthma Predictive Index (API). Visible mold was evaluated by means of home inspection. (1-3)- β -D-glucan levels were measured in settled dust. Children were considered to be at high risk for asthma at later ages if they reported recurrent wheezing at the age of 3 years and met at least 1 of 3 major or 2 of 3 minor API criteria. Results indicated that children aged 3 years with high visible mold in the home during infancy were 7 times more likely to have a positive API than were those with no visible mold (adjusted odds ratio [aOR], 7.1; 95% confidence interval [CI], 2.2-12.6). In contrast, at low (1-3)- β -D-glucan levels (<22 μ g/g), children were at increased risk of a positive API (aOR, 3.4; 95% CI, 0.5-23.5), whereas those with high (1-3)- β -D-glucan levels (>133 μ g/g) were at decreased risk (aOR, 0.6; 95% CI, 0.2-1.6). Of the other covariates, mother's smoking was the strongest significant risk factor for the future development of asthma based on a positive API (aOR, 4.4; 95% CI, 1.7-11.6). The researchers concluded that the presence of high visible mold and mother's smoking during infancy were the strongest risk factors for a positive API at the age of 3 years, suggesting an increased risk of asthma. High (1-3)- β -D-glucan exposure seems to have an opposite effect on API than does visible mold.

Sibship Size and Prevalence of Allergic Disorders in Japan: The Ryukyus Child Health Study. Ohfuji S, Miyake Y, Arakawa M, et al. Pediatr Allergy Immunol. Published Online: 24 Aug 2008.

A number of epidemiological studies have reported an inverse association between increasing sibship size and allergic disorders. The present cross-sectional study assessed the

association between the number of siblings and the prevalence of allergic disorders during the past 12 months in Japanese schoolchildren. Study subjects were 22,750 children aged 6–15 yr in Okinawa. The outcomes were based on diagnostic criteria from the International Study of Asthma and Allergies in Childhood. Adjustment was made for age, gender, maternal age at childbirth, duration of breastfeeding, region of residence, smoking in the household, paternal and maternal history of asthma, atopic eczema, and allergic rhinitis, and paternal and maternal educational level. Significant exposure–response associations were observed between increasing total sibship size and all outcomes under investigation. Having two or more older siblings was significantly inversely related to the prevalence of atopic eczema and allergic rhinoconjunctivitis, but not wheeze or asthma. Having two or more younger siblings was independently associated with a decreased prevalence of atopic eczema, but not wheeze, asthma, or allergic rhinoconjunctivitis. The inverse relationships between sibship size and the prevalence of allergic disorders under study were weakened with advancing age, although the interactions between age groups were not statistically significant. No significant interactions were found in the association of having three or more siblings with allergic disorders between children with a positive or negative parental allergic history. These results are likely to support the in utero programming hypothesis because it is probable that the in utero environment would change with parity, although the researcher’s observations could not refute the hygiene hypothesis.

Altered Early Infant Gut Microbiota in Children Developing Allergy up to 5 Years of Age. Sjögren YM, Jenmalm MC, Böttcher MF, et al. Clin Exp Allergy. 2009;39(4):518-26.

Early colonisation with bifidobacteria and lactobacilli is postulated to protect children from allergy, while *Clostridium (C.) difficile* colonisation might be associated with allergic disease. Previous studies of infant gut microbiota in relation to subsequent allergy development have mostly employed culture-dependent techniques, studied genera of bacteria and the follow-up period was limited to 2 years. To relate gut microbiota in early infancy, notably bifidobacteria and lactobacilli at species level, to allergy development during the first 5 years of life and study if environmental factors influence the early infant gut microbiota. Faecal samples were collected at 1 week, 1 month and 2 months after birth from 47 Swedish infants, followed prospectively to 5 years of age. Bacterial DNA was analysed with real-time PCR and related to allergy development, family size as well as endotoxin and *Fel d 1* levels in house dust samples. Primers binding to *C. difficile*, four species of bifidobacteria, two lactobacilli groups and *Bacteroides fragilis* were used. Children regarded as allergic manifested allergic symptoms and were skin prick test positive during their first 5 years while non-allergic children were neither. Children who developed allergy were significantly less often colonised with lactobacilli group I (*Lactobacillus (L.) rhamnosus*, *L. casei*, *L. paracasei*), *Bifidobacterium adolescentis* and *C. difficile* during their first 2 months. Infants colonised with several *Bifidobacterium* species had been exposed to higher amounts of endotoxin and grew up in larger families than infants harbouring few species. The conclusions drawn were that a more diverse gut microbiota early in life might prevent allergy development and may be related to the previously suggested inverse relationship between allergy, family size and endotoxin exposure.

The IFH Secretariat
secretariat@ifh-homehygiene.org
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